# 3.6 WATER RESOURCES

## 3.6.1 SCOPE OF ANALYSIS AND ANALYSIS METHODS

The Purpose and Need of the Travel Management Planning Project includes "Integrate resource considerations into the route system" (Chapter 1, Table 1-5, of this FEIS), and "designation of motorized routes impacts water resources…" on the Bitterroot National Forest is noted as an issue (Chapter 2, Table 2-1, of this FEIS). This section provides results from the water resource analysis for this project, to compare how alternatives achieve the Purpose and Need and how they may affect water resources.

The analysis area for water resources totals approximately 1,127,243 acres, and includes all the 6th-level watersheds, or hydrologic units (12-digit Hydrologic Unit Code, HUC6), that have contributing area within the Bitterroot National Forest, and also have area outside of Designated Wilderness that could be affected by this project's proposed changes in motorized travel. In the direct and indirect effects assessment, proposed access changes were analyzed for effects in each 6$^{th}$-level watershed. For the cumulative effects portion of this analysis, much of the data has been summarized for the entire water resources analysis area, or for a specific subset of watersheds, to better display overall effects of the project.

This scale of analysis was chosen as 6$^{th}$-level watersheds are the smallest currently mapped watersheds available, and are better to display effects from this type of project than larger mapped watersheds. The watershed boundaries define the hydrologic and sediment contributing area to water resources (streams, wetlands, and lakes) potentially affected by this project. The Water Resources analysis area is larger than the project area, as stated in FEIS Section 1.1, as many 6$^{th}$-level watersheds with motorized route systems also have the headwaters portion of their area in Designated Wilderness, which is not included in the project area. Since the Travel Management Planning Project decision will not affect those watersheds that are *entirely* within Designated Wilderness, those watersheds were not included in the analysis. A complete list of the 6th-level watersheds within the Water Resources analysis area and their primary streams is located in the {Project File folder 'water_resources,' Project File document WAT-001.pdf}.

### A. Effects Estimation and Comparison

This project determines whether motorized/mechanical transport is allowed on various routes, and in the case of motorized access, the season of use and type of motorized vehicle. Other motorized access on-the-ground activities that produce direct effects to water resources (e.g., building new trails or roads and the associated stream crossings, removing culverts, and decommissioning routes) would be covered in separate, site-specific NEPA analyses and decisions prior to their implementation. Therefore, this analysis focuses on ways to determine direct and indirect effects to water resources from the changes in motorized/mechanical transport use on existing routes.

The amount of road within a given area (often expressed as road density) can be an indication of runoff and water quality concerns. Chronic fine sediment problems have often been traced to high road and crossing densities, particularly when the areas near streams are examined. Roads can increase surface and subsurface drainage efficiency, routing upslope waters to natural channels at higher rates and increasing sediment and floodwater levels (Gucinski et al. 2001, USDA Forest Service 2000a, Trombulak and Frissell 2000, Eaglin and Hubert 1993, Furniss et al. 2000, Megahan and King 2004, Ouren et al. 2007). Roads have resulted in elevated sediment levels where stream channels are confined by fill slopes, when vegetation buffers between roads and streams are not adequate, and at crossing locations (Brown 1994, Taylor et al. 1999, USDA Forest Service 2000a, Furniss et al 2000, Ramos-Scharron and MacDonald 2007). Chin et al (2004) concluded that the presence of an ATV trail system, along with unauthorized routes, was responsible for adverse changes in fine sediment, pool depth and volume at the watershed scale. Results from studies with environmental settings similar to the Bitterroot National Forest indicate the analysis area is susceptible to road and trail erosion and associated sediment delivery to streams (Megahan and King 2004, Sugden and Woods 2007, Weaver and Dale 1978). Fine sediment has been shown to negatively affect aquatic ecosystems at several levels (Newcombe and MacDonald 1991, USDA Forest Service 2000a, Luce and Black 2001), and may prevent achievement of State-assigned beneficial uses. Please see the Fisheries and Aquatic Habitat section of Chapter 3 (3.7.3 Affected Environment) for more discussion on aquatic effects of fine sediments.

The most direct hydrologic connection between disturbed soils of travel routes and stream channels occurs at road/stream crossings due to the minimal amount of vegetative filtering occurring at these sites, Taylor et al. 1999, Furniss et al 2000). Trails and roads may also affect sediment when there is an inadequate vegetation buffer between the route and stream and at crossing locations (Brown 1994, USDA Forest Service 2000a, Ourent et al. 2007, Welsh 2008, Coe and Hartzell 2009). Foltz and Meadows (2007) suggests that ATV trails are high-runoff, high-sediment producing strips on low-runoff, low-sediment producing landscapes. For six study sites across six states, they found that sediment concentrations generally tended to increase with increasing disturbance levels, and that curved trail segments were disturbed more readily than straight segments. Although runoff did not appear to increase for the Montana site, sediment increased by approximately 625 percent, compared to the undisturbed, pre-traffic forest floor. The study concludes that ATV traffic adversely affects natural resources regardless of type, size, or tire type. The study also suggests "that to simply limit ATV traffic to trails is not enough to protect the natural resources. Trail planning and design, particularly trail location, are key considerations for limiting disturbance to natural resources." The Foltz and Meadows (2007) study focused on new trail creation and did not study ATV use on road prisms, which is common within the analysis area. McDonald et al. (2004), in a cumulative effects study, found that native surface roads and trails contributed much more sediment than undisturbed, vegetated sites. The study reported a mean sediment production rate for OHV trails of 0.4 kg m-2 and 0.001 kg m-2 from minimally disturbed sites. Types of OHVs using the trails were not quantified. Once a trail or road becomes established; the soil of the tread is subject to the continuing erosional forces of rainfall, running water, wind, freeze/thaw cycles, gravity, maintenance, and traffic (Sugden and Woods 2007, Megahan and King 2004, Leung and Marion 1996), and to some extent is maintained in an unvegetated, disturbed, condition. This would be true of routes originating from any source (motorized or nonmotorized) that are maintained as open trails. Trails within Designated Wilderness areas show erosion and deposition changes over time due to nonmotorized traffic and water effects (Cole 1991), and nonmotorized trail erosion studies indicate horses, hikers, and llamas can all cause trail disturbances (DeLuca et al 1998).

Few studies directly compare erosion or sediment rates between modern motorized trail vehicles and foot or horse travel. Weaver and Dale (1978), in a Southwest Montana study, found that hikers, horses, and motorcycles generated somewhat similar levels of trail erosion, although each type of travel had unique effects. They found horse and foot travel produced more erosion than motorcycle use on downhill trail segments, while motorcycle use produced more than foot or horse on uphill segments. Wilson and Seney (1994) found horse use produced more erosion than foot, motorcycle, or mechanized travel. They also suggest that two-wheeled cycle traffic (motorcycle or bicycle) results in less sediment than either horse or foot traffic, although the actual data appears to suggest foot traffic produces the least sediment and horse traffic the most. Both Weaver and Dale (1978) and Wilson and Seney (1994) used motorcycles that would be considered quite small today (90 and 125 cc displacement, respectively), and impacts will differ with larger, more powerful versions. Weaver and Dale (1978) note that motorcycles ridden at speeds higher than used in the study (20 km or 12.4 miles/hour) might make them more damaging than horses, and therefore put them at the top of the trail-impact ranking. Overall the studies imply that "walkers" (horses and hikers) tend to generate more erosion on downhill trail segments than "rollers" (bicycles and motorbikes), while on uphill segments motorbikes tend to produce more erosion than "walkers" or bicycles due to their ability to maintain wheelspin for longer distances (Cessford 1995).

Studies of trail-using mechanical transport (bicycles and game carts) have focused on comparing mountain bikes with foot traffic effects, with some studies expanding to include motorcycles. Thurston and Reader (2001) summarized that hikers and bikers created similar disturbances on new routes, with similar recovery rates if use was discontinued. White, et al (2006), in a study that included trail characteristics and ecological/climate groupings, summarized "The findings from this study reinforce results from previous research that certain impacts to mountain bike trails, especially width, are comparable or less than hiking or multiple-use trails, and significantly less than impacts to equestrian or off-highway vehicle trails." Wilson and Seney (1994), as noted above, found that hiking and biking effects to trails were similar, and in some cases mountain bikes produced less erosion than any other travel mode. Not all literature agrees, however, that mountain bikes should be considered "low" impact. Vandemann (2004, 2006), in an unpublished personal review of mountain bike impact research, claims that few of these studies have used suitable scientific rigor and the claims made by the authors are suspect. Vandemann (2004, 2006) relies on personal experience, anecdotal evidence, and perceived weaknesses in studies such as White, et al (2006) to conclude that mountain bike effects to soils and wildlife have been under-rated in the available literature, or findings misapplied in literature reviews. Cessford (1995) found in his literature review: "It has not been established in the research done to date, that mountain bikes have greater overall impact on tracks than do walkers. However, it is obvious that mountain bikes do have some different types of impacts. The research to date indicates that it would not be appropriate to state that one is any "worse" than the other. It would appear that the main physical impact implication from the advent of mountain biking really lies in the increase in user numbers they may represent, rather than in the nature of the new activity in itself. More research on the issue of comparative effects between activities is generally required." Cessford (1995) concluded that physical impacts of hikers and mountain bikers were different but at similar intensities and the true difference in effects was social in nature.

Recreational vehicle tire pressure may affect route surface erosion rates, but little research on the topic is available. Proponents of low-ground-pressure OHVs (ATVs, some motorcycles and 4x4 vehicles with large tires) point out that the reduced tire pressure of their vehicles results in lower ground disturbance than vehicles with higher pressure tires and also various other travel modes, such as horse travel. However, the available literature leaves an incomplete picture. While numerous studies (Foltz and Elliot 1999e, Grau 1990, USDA Forest Service 1997) suggest lowering log-truck tire pressures reduces road surface erosion, comprehensive studies specifically comparing tire pressures and trail effects between ATVs less than 50 inches in width and all other travel modes could not be found during literature reviews. Studies such as Sack and da Luz 2003, Foltz 2006, Foltz and Meadows (2007) and Welsh (2008) indicate that ATVs less than 50 inches in width have the capability to cause wheel ruts and erosion despite their low tire pressure. The Forest Service has often managed vehicles 50 inches or less in width with low-pressure tires different than larger vehicles, in part due to perceived reduction in road surface disturbance compared to full-sized cars or trucks, or UTVs (Utility Terrain or Utility Trail Vehicle) greater than 50 inches in width that do not meet the criteria. The reduction in route disturbance is believed to be due to a narrower profile, less weight than wider vehicles, and the relatively wide, soft tires. The Foltz and Elliot (1999e), Grau (1990) and USDA Forest Service (1997) studies suggest lower tire pressures such as those used by the ATVs defined above (50 inches or less in width, low-pressure tires) would reduce erosion on road prisms when compared to full-size vehicles such as trucks or jeeps without low-pressure tires. It is more difficult to apply the results to the uneven and often steeper surfaces of trails, as few studies are available on this topic. Trail #39 (Chain of Lakes Trail) is used primarily by ATVs less than 50 inches in width, but disturbance and erosion is still substantial in some segments. In contrast, road prisms currently closed to full-size vehicles, but open to vehicles 50 inches or less in width such as Road #49 (Piquett Creek) behind the closure to full-size vehicles lack wheel ruts, have less loose soil and appear to be more stable than roads open to full-size vehicles or steep ATV trails such as Trail #39. This wide range of effects from the same vehicle suggests that the vehicle characteristics (including low tire pressure) are not the only factor determining the amount of erosion it can cause.

Overall, the relative trail impact ranking of various types of travel have not been well defined across whole trail systems by available literature (Pickering, et al 2010). Regardless of ranking, each travel mode appears to have impacts, and contributes to the overall use and effects. What seems apparent in many studies is the relationship between level of use and trail erosion. Weaver and Dale (1978), Wilson and

Seney (1994), and Foltz and Meadows (2007) found that trail impacts increased with the number of passes for each studied travel mode. When other environmental variables are held constant, the level of a route's surface disturbance is dependent on the total amount of use, including all motorized and nonmotorized travelers. This concept is supported by road studies that show increased amounts of sediment with increased traffic levels (Reid and Dunne 1984, MacDonald et al. 2001), and reductions in sediment with road closure (USDA Forest Service 2000a). This analysis therefore assumes that since all travel modes share certain trail effects (e.g. vegetation modification and surface erosion), a change in the amount of use by any travel type (nonmotorized or motorized) would bring about a corresponding change in trail erosion and sediment production on those trail segments prone to such processes. Designated routes would be maintained and other travel modes and their effects would continue; foot, horse and possibly mechanized traffic would continue to create travel route erosion regardless of motorized access status (Deluca et al. 1998, Cole 1991). In the case of closing a specific trail segment to both motorized and mechanized access, two different travel modes and their user groups would be restricted, which would reduce overall use levels, and associated trail effects, more than restricting one travel mode alone.

Current motorized routes across the Forest differ greatly in their origin, design, use levels, and environmental characteristics, but those in close proximity to streams share a common risk of affecting water quality through erosion and sedimentation, which is the production, deposition, or accumulation of sediment. Determining erosion or sedimentation levels for the complex mix of trail design, location, width, conditions, use levels and grades makes a high-resolution analysis difficult. Good data on many variables is not available. For example, motorized trails may be located on old logging road prisms, with different erosion characteristics than those that originated as old foot or horse trails. ATV, motorcycle, mechanical, foot, and horse traffic all mix on trails for vehicles 50 inches or less in width, making it difficult to determine the amount of impact attributable to a given travel mode, or the level of improvement realized from limiting one or several travel modes.

Overall, published literature strongly supports the idea that motorized access adds to the total sediment load originating on multiple-use trails, but is not solely responsible. Dividing the sediment load between all the travel modes existing on a route system is difficult with limited trail data. Nevertheless, law requires analyzing effects of the changes in motorized access proposed in this project. Therefore, to estimate potential direct and indirect effects to water resources those areas and routes open to motorized use that are within 300 feet of streams, ("connected disturbed areas" or "CDA") were determined with Geographic Information System (GIS) layers, and then modeled for sediment potential or "risk." **The model results are intended as an indicator to compare sediment risk between alternatives, rather than an absolute value of motorized sediment.**

## Assumptions and Limitations of Analysis Methods

To address the shortage of specific trail use, erosion and sediment data, the effects analysis model used several simplifications which applied similarly to all alternatives. These included:

- Using a "worst-case" scenario that addressed the potential growth in motorized use over the life of the travel plan. This approach estimated the maximum probable sediment risk by using values that represented a relatively large disturbed area for trails and the area open to motorized wheeled access for dispersed camping, compared to the area disturbed seen in motorized routes during field reviews.
- Grouping motorized single track and two-track (50 inches or less in width) trails into one motorized travel mode and assigning an average disturbance width. Field observations suggest the disturbed (and therefore, prone to erosion) width of trails varies widely. Trail tread width observed in the field varied from near zero on fully-vegetated, rarely-used single-track and ATV routes to about twenty-two feet on high use ATV routes {Project File folder 'water_resources,' Project File document WAT-013.pdf}. Due to the difficulties in representing the combination of variables that affect erosion from these uses on a Forest-wide basis (e.g., use levels, disturbed widths, soil type,

percent rock armor, slope, slope length and precipitation), a fixed width was chosen and used for all alternatives. To represent the trails seen in the field and also address potential growth in motorized use and associated disturbance, a width of four feet of disturbed area was used in trail calculations. This disturbed width is twelve feet less in width than that used for full-sized motorized routes, and acknowledges the smaller width, lower weight, and lower tire pressure for vehicles meeting criteria for "50 inches or less in width" trails. Also, with the exception of two trails for motorized vehicles 50 inches or less in width, all other routes for this type of vehicle are located on existing road prisms, which, due to lower grades and more consistent travelling surfaces, generally have less erosion and sediment production. For these reasons, routes for vehicles 50 inches or less in width were assigned a smaller disturbed width and therefore a lower sediment rate than full-sized vehicles.

- Assigning all road segments within 300 feet of streams open to full-sized motorized use an average disturbance width of 16 feet. This represents the upper end of the range seen in field reviews, and was chosen to represent the potential disturbance possible with increased forest use, including road grading. Sixteen feet is also the desired width specification on many high-use forest roads. Most road surfaces average twelve to fourteen feet, but turnouts and curve widening range up to thirty feet in places.
- Assigning a uniform erosion rate measured during erosion research on western Montana road surfaces (Sugden and Woods 2007), to both the road and motorized trail sediment models. The chosen erosion rate was measured on open roads with similar geology and climate influences as the Bitterroot National Forest. A single erosion rate cannot accurately predict effects on the wide range of environmental conditions that exist on a route system (e.g. route slope, soil type, annual precipitation), but was used as the environmental conditions are considered constant for all alternatives and, therefore, the relative modeled erosion rate for each alternative would remain constant. In other words, the amount of error due to the simplification would be the same for each alternative, and would not change the relative ranking of that alternative for motorized access effects.
- Leaving mechanical transport travel out of the quantitative sediment analysis and discussing mechanical transport travel effects for each alternative in a qualitative fashion. Studies from Cessford (1995), White et al (2006) and Wilson and Seney (1994) are not fully definitive of mountain biking's impacts, but suggest the inability of mountain bikers to produce more than very minor uphill wheelspin reduces their impact dramatically when compared with the average motorized trail vehicle.

A background sediment load was calculated for each watershed (303(d)-listed, non-listed, and all watersheds) for each alternative, using Kirchner et al.'s (2001) values for landscape-level background sediment in nearby large watersheds. Sugden and Woods' (2007) rates for road surface erosion in Western Montana and the CDA for each watershed were used for road and trail surfaces within 300 feet of streams, at the widths described above, to develop a motorized sediment risk indicator. The potential sediment risk estimates for each alternative with their differing proposed levels of motorized access are then compared to the existing conditions and each other. This comparison assumes that eliminating motorized travel on specific routes or areas would reduce overall use and soil disturbance and, therefore, reduce sediment risk, with the opposite action (adding motorized access) causing an increase in sediment risk (USDA Forest Service 2000a). The modeled sediment levels are also compared to background levels for the watersheds, and discussed in the context of several independent sediment studies (Megahan and King 2004, Jordan 2006) that relate the amount of sediment to its potential effects on stream channel conditions. Please see the "Strengths and Weaknesses" of this model (below) for more discussion.

The indicator was chosen after reviewing the available data and feasibility of analyzing complex water resource impacts on a large scale. Use of the CDA concept can be found in the Forest Service Handbook (FSH2509.25-10), Watershed Conservation Practices Handbook section. The complexity of changes in the various alternatives includes changes in several variables, in many different watersheds, creating a need to determine the net change in effects for each watershed for each alternative. To best estimate effects to water resources, all potential motorized disturbances within 300 feet of streams were mapped and integrated into a single indicator, Total Potential Motorized Sediment – Percent of Background. All alternatives used the same assumptions for the model, so any errors or inaccuracies in the model would be similar across the alternatives. The following disturbances were included:

- *Open motorized routes within 300 feet of streams*- Scientific literature suggests roads and trails close to streams are often primary sediment contributors (USDA Forest Service 2000a, Frissell 1996, McDonald and Stednick 2003, Furniss et al 2000, MacDonald and Coe 2008, Coe and Hartzell 2009, Megahan and King 2004). The INFISH Forest Plan amendments also recommend a 300 foot buffer of controlled activities for fish-bearing streams to minimize impacts, suggesting this is an appropriate area to consider. All motorized access within 300 feet of streams was considered as a disturbance with sediment-production potential. Including all open motorized routes was considered necessary to model a conservative or "worst-case" scenario.
- *Areas open to motorized wheeled access for dispersed camping within 300 feet of streams* **-** since motorized access for dispersed camping is proposed to allow campers to travel a certain distance to their sites, and this travel off motorized routes may disturb soils and create erosion problems, the motorized access for dispersed camping corridor was included in the measurement indicator calculations. The potential for sediment contribution from this source was estimated by determining where the dispersed camping motorized access corridor (600 feet for **Alternatives 1, 2, and 3**, or 300 feet for **Alternative 4**) overlapped the area within 300 feet of streams. The area inside the overlap was reduced by eliminating slopes over 30 percent, as these areas are less preferable to travel cross-country or camp on (Project File Document WAT-014.pdf). The area that met these criteria is included in calculations for the measurement indicator for each 6th-level watershed. This was considered a conservative or "worst case" scenario, as the total corridor open to motorized access for dispersed camping is rarely used due to natural barriers, such as standing and down trees, large rocks, thick vegetation, water features, and narrow stream canyons, even after eliminating steep slopes. The erosion rate used to model potential sediment from motorized access for dispersed camping was reduced to 30 percent of the road and trail surface rate to address the lower traffic volume and lack of grading disturbance, and to respond to general field observations.
- *Unauthorized routes within 300 feet of streams* – Unauthorized (non-system) routes within 300 feet of streams have a high probability of being sediment sources as they were generally created without considering water resource effects (Chin et al. 2004). High route grades and lack of maintenance make unauthorized routes more prone to erosion than system routes. Associated areas of motorized access for dispersed camping were also included in the estimation, since the routes built before the 2001 Tri-State Decision are currently open for this use.

Table 3.6-1 displays the water resource impact indicator and the method of deriving it, below.

***Table 3.6- 1: Measurement Indicator for Water Resources Analysis***

| Measurement Indicator | Analysis Methods |
|---|---|
| Total Potential Motorized Sediment (tons/yr and percent of background level), estimated for 6th-level watersheds (direct and indirect effects) and grouped watersheds (cumulative effects) | Road and stream GIS layers were overlaid to determine how much road or trail was within 300 feet of streams, and therefore capable of contributing sediment and considered as CDA. Dispersed camping access corridors, limited to slopes less than 30 percent, and unauthorized routes within 300 feet of streams, were also included as potential sediment sources. Total motorized CDA was estimated for each 6th-level watershed, for each alternative. Local erosion values for motorized routes were then applied to develop the Total Potential Motorized Sediment value and |

| Measurement Indicator | Analysis Methods |
|---|---|
| | to compare estimates to background levels and the existing condition. |

Most wetlands on the Bitterroot National Forest are associated with channel margins or valley bottoms, and are within 300 feet of streams. Travel planning effects to these sensitive landforms will, with the exception of some isolated wetlands, be included in the measurement indicator due to their shared location. Motorized access designation effects to wetlands are similar to those associated with streams: potential sedimentation, direct disturbance, and erosion. Therefore, wetland effects are considered within the water resource effects analyzed and discussed within this section. Effects discussed for stream channels also apply to streamside wetlands.

Isolated wetlands are best located through the use of soils maps, which indicate hydric (generally saturated) soils. Please see Soils, Chapter 3, Section 3.8.3 C (Soils Sensitive to Off Route Motorized Travel) for discussion on the Affected Environment, and Table 3.8-2 for a display of existing motorized route mileage on hydric soils. Hydric soils effects discussion for each alternative is included in Soils Section 3.8.4.

Water *quantity* can be an issue when management-related water yield contributes to accelerated stream bank erosion, resulting in habitat degradation and additional sedimentation. However, water quantity will not be analyzed as the Travel Management Planning Project yields a simple "open or closed" decision on the existing route system, which will not alter forest cover and, therefore, have no effect on water yield. Designating existing unauthorized routes or building short connector routes would affect such a small portion of the watershed that these activities would not affect water yield. For these reasons, a water quantity measurement indicator was not included.

The vast majority of routes are outside of the area where the motorized access proposals can influence water resources, and changes in routes farther than 300 feet from streams are therefore not considered in the water resource analysis. Management or use of these routes and areas more than 300 feet from streams has little potential to affect streams and, therefore, they were not included in the indicator or discussed in detail.

The use of Total Potential Motorized Sediment – Percent of Background as an indicator to determine water resource risk from the project's alternatives has certain strengths and weaknesses.

***Strengths:***

- Effects of sediment from streamside roads and crossings are reasonably well-documented in scientific literature. A majority of researchers find increasing negative watershed effects, such as degraded fish habitat and beneficial use support, linked to increasing road and motorized trail networks.
- The indicator focuses on motorized access near streams, where it has the greatest probability to affect water quality. It improves upon models that do not differentiate between streamside and upland disturbances.
- Effects of increased traffic are reasonably well-documented in scientific literature. Many researchers associate route erosion and sediment levels with motorized traffic levels. Over time, road and trail erosion levels and associated sediment potential will respond to changes in use, supporting corresponding changes in sediment and beneficial use achievement.
- Relatively easy to calculate – a single value represents the total of multiple activities, allowing a comparison of net changes between alternatives.
- A consistent level of accuracy for all alternatives, allowing the comparison of alternatives to each other.
- The Public and the Responsible Official are reasonably familiar with sediment and effects
- Relates to pollutant source for almost all Bitterroot National Forest 303(d)-listed streams (sediment)

- Ø "Percent of Background" values standardize for watershed size and allow comparison between different size 6th-level watersheds
- Ø The model's erosion rates are from relatively local studies (central Idaho, western Montana), in similar landscapes and climates.
- Ø ID Team personnel are familiar with implications of model results from common use in other projects (e.g., timber sales).

***Weaknesses:***

- Ø GIS layers are not entirely accurate – "false crossings" or inaccurate road segment lengths may exist due to spatial inaccuracies of either road or stream data. The level of error would be similar across all alternatives. Situations where streams and roads run parallel were reviewed manually and corrected to the extent feasible to reduce the amount of error.
- Ø Sediment models are simplifications and have inherent inaccuracies. The one used in this analysis has these characteristics but provides a simple estimate that can be used to compare potential effects of alternatives. A "conservative," worst-case scenario was used to address growth in motorized forest recreation over the life of the travel plan.
- Ø Changes in the indicator as a result of selecting an alternative will not immediately translate to measureable watershed health changes (increasing or decreasing), due to continued existence of the route, ongoing nonmotorized use, and varying length recovery periods. A "lag time" will exist between implementation of an alternative and changes in water resource condition in most cases. The degree of change in effects (increase or decrease in sediment) will be directly related to the amount of use a trail or road segment was receiving before the change was implemented. For example, a trail with high levels of motorized use will show a bigger change in effects after a motorized closure is implemented than a trail with low levels of motorized use.
- Ø Since actual effects depend on many use and environmental characteristics (e.g., trail use levels, weather, maintenance, design), the model results are considered an indicator of risk rather than an absolute sediment value. The concept of risk (something that creates a hazard, possibility of loss or injury) is included in effects discussion, as the opening of a trail to motorized use does not in itself create an effect, but opening the trail to motorized use creates the possibility that the trail will be used and affected by that use. Due to the difficulty of predicting use on Forest-wide trail systems, this model is simplified and assumes that trails open to motorized access will see a sufficient amount of use to disturb soils and cause erosion (see "worst case scenario", above).
- Ø Professional judgment is required to interpret the actual water resource effects associated with a change in the indicator, and opinions may vary on what constitutes a meaningful change. This assessment uses Jordan (2006) as a guideline for effects significance interpretation. Jordan (2006) felt that changes in sediment load greater than ten percent of background levels within a given watershed were detectable and "...the sediment input would probably be measurable, and depending on its timing and location, it may have a detrimental impact on water quality for a short time, or on the stream channel at some location." Jordan (2006) also comments on sediment changes of one percent of background levels "…, the sediment input is much less than the measurement error of sediment yield. Although it might be observed at the source location (for example, a road washout), it would probably be immeasurable at the watershed outlet." Using these figures, the Water Resource assessment assumes sediment changes of one to nine percent are localized effects observable at or adjacent to source areas, and changes of ten percent or more are observable at both source areas and at the watershed outlet, and are therefore more significant.
- Ø The model assumes equal water resource impacts for all streamside disturbances, and similar response to changes in the indicator between alternatives. A value from local erosion studies was used as a representative average consistently across all alternatives to help address these concerns and better display relative differences between them. In reality, disturbed areas and routes within 300 feet of streams and stream crossings differ in their design, use patterns, and environmental conditions, and therefore, their impacts to water resources (Luce and Black 2001). Water resource

benefits from changing trail segments within 300 feet of streams from motorized to nonmotorized (or from mechanical to nonmechanical) would also vary for the same reasons, but would in most cases would eventually be realized due to a reduction in overall use.

The information used in this analysis comes from GIS analysis, directly from field examination of the analysis area, and ground surveys of proposed new routes. Information from past surveys and project-specific analyses was also considered. Current literature cited above influences how the GIS data was interpreted and used in the analysis.

## 3.6.2 Regulatory Framework

### A. Bitterroot National Forest Plan

The Bitterroot National Forest Plan (USDA Forest Service 1987a) provides direction to protect and manage resources. Only direction pertaining to the Water Resources portion of this project is included here. Forest-wide goals and standards, and Federal regulations apply to all management areas.

The Forest Plan forest-wide goal for soil and water resources is to:

- Maintain soil productivity, water quality, and water quantity (USDA Forest Service 1987, II-3).
- Forest–wide Management Objectives state how resources will be managed under the Forest Plan:
- Manage riparian areas to prevent adverse effects on channel stability and fish habitat (USDA Forest Service 1987a, II- 6).

Forest-wide Management Resource Standards provide further detail:

- As part of project planning, site-specific water quality effects will be evaluated and control measures designed to ensure that the project would meet Forest water quality goals; projects that will not meet State water quality standards will be redesigned, rescheduled, or dropped. (USDA Forest Service 1987a, II-24)
- Soil and water conservation practices will be a part of project design and implementation to ensure soil and water resource protection (USDA Forest Service 1987a, II-25).
- Actively reduce sediment from existing roads. Sediment reduction measures to be considered include:
    - Cross-drains into vegetative filter strips away from streams,
    - Grass seed, fertilizer mulch and netting on cuts and fills,
    - Slash filter windrows or straw bales at toe of fill in contributing areas; and
    - Gravel ditches and road surfaces (USDA Forest Service 1987a, II-25)

Management Areas 1, 2, 3a, 3c, and 8a have another Management Standard that pertains to water resources. The relevant Management Standard is:

- Utilize watershed rehabilitation projects such as stabilizing road cut or fill slope slumps to repair problems. (USDA Forest Service 1987a, III-6, 12, 18, and 59)
- Management Area 5 Management Standards protecting water resources include;
    - Management activities will be designed to protect the municipal watershed. (USDA Forest Service 1987a, III-40)
    - Trail improvement or construction will be implemented with emphasis on soil stability and stream protection (USDA Forest Service 1987, III-40).

### B. Montana State Regulations

Various Montana State regulations provide a regulatory framework for water resources:

**Administrative Rules of Montana (ARM) 16.20.603**

Best Management Practices (BMPs) are the foundation of water quality standards for the State of Montana. The Forest Service has agreed to follow BMPs in a Memorandum of Understanding with the State of Montana (MDEQ 2008). For the Travel Management Planning Project, BMPs related to planning are pertinent; those related to implementation or maintenance would be discussed during NEPA documentation for on-the-ground projects. Planning BMPs used in this project include:

- Locating potential new routes away from streams and minimizing stream crossings
- Locating potential new routes on appropriate slopes, soils and landforms
- Avoiding duplicate routes

Implementation BMPs would be developed and implemented for new trail construction if this activity occurs.

**ARM 17.30 Sub-chapter 6**

This regulation details water quality standards for the State of Montana. The Forest Service has primary responsibility to maintain these standards on lands under their jurisdiction in the State of Montana.

### C. Clean Water Act

The Clean Water Act (CWA) and its various amendments are the foundation of water resource protection in the United States, and provide guidance at all levels of management. Pertinent components of the CWA include:

- Section 208 of the 1972 amendments to the Federal Water Pollution Control Act (Public Law 92-500), which specifically mandates identification and control of nonpoint-source pollution resulting from silvicultural activities.
- Clean Water Act, Sections 303, 319, 404. Section 303(d) directs states to list water quality impaired streams, and to develop total maximum daily loads (TMDLs) to control the pollutant causing loss of beneficial uses. The 2012 Montana 303(d) list of Water Quality Impaired Streams (MDEQ 2012) is used in this report as it is the most recent assessment. Sediment is the only pollutant likely to be affected by this project, and sediment TMDLs have been developed for the entire Bitterroot River (MDEQ 2006b, MDEQ 2011). Section 319 directs states to develop programs to control non-point source pollution, and includes federal funding of assessment, planning and implementation phases. At the time of this analysis, no known Section 319 projects would be detrimentally affected by proposed project activities. Section 404 controls the dredge and fill of material in waterbodies of the United States. The current proposal for the analysis area does not contain any activities that need special permits under this regulation. Any activities developed in the course of this analysis will be properly permitted under the CWA and Montana Department of Environmental Quality (MDEQ) regulations before implementation.

### D. Executive Orders 11988, Floodplain Management and 11990, Protection of Wetlands

Executive Order 11988, Floodplain Management, requires Federal agencies to reduce the risk of flood losses and preserve floodplains by limiting new construction in floodplains. Executive Order 11990, Protection of Wetlands, requires Federal agencies to minimize loss of wetlands and wetland quality through consideration of effects and minimization of new construction in wetlands.

## 3.6.3 Affected Environment

The Bitterroot National Forest has a stream network with varied water quality and habitat potential. The interaction of parent geology and natural processes such as climate and geologic movement, along with human influences, has created the stream system that exists today.

There are a number of streams listed for water quality impairments, discussed in the section on CWA S303(d), below. These impairments occur when human-related activities overwhelm the stream systems' ability to absorb a given pollutant, causing stream health, water quality or habitat to degrade below what the stream is naturally capable of supporting.

## A. Introduction

Both natural events and human activities have the potential to impact soil, water, and riparian resources across the Bitterroot National Forest, subject to climate variation and implementation of management direction. Natural events include wildfire and floods, while human activities include road and trail construction, timber harvest, cattle grazing, and recreation. The degree of impact depends upon project design guidelines, the soil and hydrologic characteristics of the watershed, and how sensitive and resilient watersheds are to these disturbances. Soil and hydrologic characteristics are dictated by local landform, geologic material, and climate, and therefore vary extensively across the landscape.

## B. Natural Characteristics and Processes

Natural disturbance events such as wildfires, wind events, and floods continue to influence hydrologic and erosion processes within the watersheds of the analysis area. Given the current vegetative conditions, drought, and associated fuel accumulations, there is potential for wildfires to occur that may be outside the range of conditions (intensity and duration) that have occurred over the last few hundred years. Wildfires on the Bitterroot National Forest have been extensive over the past 10 years, with almost 1/3 of the Forest seeing some level of wildfire. Intensity has varied, from unusually extreme fire storms to mild underburns. Depending on the intensity and area burned, accelerated soil erosion is possible, particularly where hydrophobic soils may be formed. Channel adjustments are expected, especially during years of average or higher precipitation/runoff conditions. Stream systems will stabilize as vegetative recovery progresses.

Watersheds are dynamic systems, regardless of human influence. Deep snow packs and heavy spring rains can cause substantial flooding, landslides, and instream erosion. Wildfire, wind, or insect and disease mortality can drastically alter the vegetation and hydrology of a watershed. Depending on the extent of mortality or vegetation alteration, impacts to stream systems can be substantial. Beneficial uses, including fisheries habitat, can be negatively affected in the short term by these natural events. However, watersheds left undisturbed after natural events, can and do recover rapidly, and ultimately provide conditions that fully support all beneficial uses within a relatively short period of time. These natural disturbances occur infrequently within a given watershed, which allows for significant and generally rapid recovery of hydrologic and erosion processes prior to the next major disturbance event. This results in *pulse* effects to water resources, which are moderate-to-high in magnitude, but low in frequency. Within the current climatic regime and prior to significant human influence, stream systems and their biota have developed under pulse type disturbances.

## C. Geology and Landform

Geologic parent material and landform varies considerably across the Forest. Landtype associations are a useful tool to describe this variability and help identify potential hazards associated with management activities and impacts to water quality. Please see the Soils section, 3.8, in Chapter 3 for discussion on soils issues.

## D. Precipitation and Flow Regimes

Elevations across the Bitterroot National Forest and the analysis area range from under 4,000 feet to over 10,000 feet. Based on a 30 year period of record, the average annual precipitation associated with these elevations ranges from about 12 to 70 inches. Although the majority of the precipitation falls as snow, a significant portion falls as spring and fall rain, especially at the lower elevations.

Streamflow regimes also vary in relation to these precipitation regimes and geologic/landform features. All watersheds on the Bitterroot Range that encompass high elevations and large areas produce substantial perennial flows, in contrast to lower elevation smaller watersheds and Bitterroot “face” and Sapphire Range streams that may be perennial, intermittent, or ephemeral systems. Please see Appendix C (Glossary) to the FEIS for definitions of stream types.

Many Bitterroot National Forest streams experienced significant flood events in the historic past. These floods of the past century contributed substantially to the current conditions along many stream reaches. These infrequent, high magnitude flood events resulted from a combination of natural characteristics and conditions; namely deep winter snow pack, cool spring temperatures, and heavy spring rain events. These conditions can be expected to repeat themselves, and the climatic conditions leading up to these infrequent events and the resulting flood stage cannot be mitigated. Except for potential localized influences on snow packs and melting rates in small headwater streams from harvest and prescribed burn activities, the frequency and magnitude of these large events, at the watershed scale, are outside of human control.

Recent flood events, in both burned and unburned watersheds, have played an important role in forming existing channel conditions. Many headwaters reaches, including ephemeral and intermittent channels, have been more sensitive during recent post-fire floods, displaying a tendency to downcut where bedrock was lacking in channel substrates. Transport reaches in the mid-elevation ranges have been generally more stable, and their channel characteristics have seen less fluctuation. Response reaches, those with meandering, relatively low-gradient channels, are somewhat rare on the Forest but common on lower-angled private lands, and have generally experienced increased sediment inflow and storage, with some channel braiding and new channel formation. Natural stream sediment is due to dry creep (gravitational movement of surface soils), overland flow and mass failures in the upper reaches and in-channel erosion in the lower reaches. In general, *sediment supply exceeds sediment transport capacity* under average or low flow regimes, and stream channel *aggradation* occurs. High flow events reverse this relationship and result in channel downcutting or *degradation.* Both aggradation and degradation are natural but can be affected by human activities.

Historically, beaver played a significant role throughout the analysis area through the development of extensive dam/pond networks on lower gradient channels. Beaver populations have been reduced relative to historic levels. Although transitory, beaver dams and ponds are an important component of riparian systems. They help to trap and store both sediment and water. A reduction in beaver populations over the years has likely resulted in lower water tables and lower late season streamflows along small, low elevation streams.

## E. Erosion and Sediment

Erosion is a natural process of geologic decomposition that occurs in all watersheds. The rate at which it occurs is a function of geology, soil and stream characteristics, precipitation and vegetative cover. There are three basic types of erosion; 1) detachment and routing of individual soil particles from the land surface; 2) mass wasting such as landslides and slumps; and 3) detachment and mobilization of stream channel banks or bottom material, i.e. instream erosion. All of these processes produce “sediment,” and all stream systems transport sediment. Sediment is a loosely-used term that can refer to a wide range of channel substrate particle sizes, e.g., silt, sand, gravel, cobble, and boulder. The larger particle sizes are generally produced through channel erosion or mass wasting, and are commonly referred to as bedload. The finer particles that are suspended in flowing water can be produced through all of the erosion processes mentioned above.

Geology and landforms within the analysis area have produced soils that are generally stable when adequately vegetated, but that are highly erodible when vegetation is removed. MacDonald and Stednick (2003) suggest that undisturbed forested watersheds typically have very low erosion rates because of high infiltration rates and limited surface runoff. Erosion rates have been estimated at less than 0.1 tons/acre/year for most forested areas in the interior western U.S. (Patric et al. 1984). USDA Forest Service 2000b summarized research concerning timber management in the northern Rockies which also suggests that erosion rates for undisturbed forested landscapes (control watersheds, no harvest/roads) are very low (0 - 0.09 tons/acre/year). Therefore, in the absence of wildfire, hillslope surface erosion within undisturbed areas across the Forest is considered to be very low. The exception to this occurs on steep, high energy (south and west facing) landforms composed of sparsely vegetated decomposed granites. Episodic precipitation events that saturate these soils infrequently result in landslides (mass wasting) that release substantial amounts of sediment to streams. These same landforms also have higher surface erosion rates. However, at the broad scale, in-stream (or streambank) erosion is considered the dominant sediment-generating process in unmanaged watersheds.

Vegetative composition is largely defined by climate and soils, but natural agents including fire and insects or disease can alter the vegetative cover. Within the last three decades, timber stands have been affected by fire, insect/disease or wind on over 300,000 acres across the Bitterroot National Forest, with concentrations on the Sula, Darby, and West Fork Ranger Districts from the 2000 fires. These events have likely resulted in substantial short-term increases in surface erosion although sediment deliveries to perennial streams have not been quantified. Most of these areas have stabilized with the profusion of ground cover that has followed the fires, but some sensitive areas remain.

## F. Human Influences

Humans have influenced watersheds and water quality for centuries. Prior to European settlement, Native Americans used fire to manipulate vegetation, which influenced hydrologic processes at the local scale. As European settlement occurred, so did uncontrolled beaver harvest, timber harvest, and forage harvest through livestock grazing. All of these activities had long term substantial impacts to watershed characteristics and hydrologic processes, some of which are still present today. Human influence on the Existing Condition and how it interacts with this proposal's effects is discussed in detail in the Cumulative Effects analysis, Section 3.6.4 C, below.

### Transportation System

At the current time, the open road and motorized trail system on the Bitterroot National Forest totals about 2,601 miles (Chapter 2, Table 2-21). GIS analysis suggests about 86 percent of the open roads and 84 percent of motorized trails are farther than 300 feet from streams, and therefore have relatively minor effects on watershed function or stream health. Changes to motorized access on this large portion of the transportation system will therefore have little impact, good or bad, on streams. This leaves about 12 percent of open roads (about 187 miles) and 16 percent of motorized trails (about 174 miles) within 300 feet of streams that have a higher potential to affect streams and water quality within the Water Resources analysis area. Changing motorized access on these route segments may have positive or negative effects on the water resource (Section 3.6.1 A).

Road and trail systems have different impacts to analysis area watersheds than natural disturbances such as wildfire or flooding. Construction and use of roads and trails close to streams can create long-term chronic erosion and fine sediment in the analysis area watersheds, while natural disturbances tend to create sediment pulse events of higher magnitude and shorter duration.

Roads modify natural drainage networks and accelerate erosion processes. Depending on distribution and design, these changes can alter physical processes in streams, leading to changes in streamflow regimes, sediment transport and storage, channel bank and bed configurations, substrate composition, and stability of slopes adjacent to streams (Furniss et al. 2000, USDA Forest Service 2000a). Numerous studies have identified unpaved roads as a major source of sediment in streams (USDA Forest Service 2000a, Megahan and King 2004, McDonald et al 2004). Sugden and Woods (2007) measured 20 unsurfaced road surface plots in western Montana and found average annual sediment yields of 5.4 Mg/ha/yr (14.7 tons/acre/year), which is much higher than from undisturbed forest. Luce and Black (2001) also determined that logging roads increased erosion over natural conditions by a large margin.

Required BMPS, such as road and trail design, surfacing of roads and trails, limiting season of use, limiting kinds of use, storing or decommissioning unneeded roads and maintaining water controlling devices, lower the risk of erosion and sediment reaching streams (Switalski and Jones 2009, {Project File document WAT-003.pdf}, but some risk exists as long as the roads and trails are in place and being used. Please see discussion below on BMPs and their use to minimize sediment risk in the analysis area.

## Road and Trail Management

Road and trail maintenance and BMP upgrades for existing roads and trails are an important part of reducing sediment effects, and are required to be compliant with the Clean Water Act and MDEQ regulations. Best management practices upgrades include improved cross-drainage, armored culvert inlets and outlets, fish-passage structures, gravel surfacing, and improved prisms {Project File document WAT-003.pdf}. All of these improvements reduce the time water is on the road and help stabilize the road surface. The installation, reconstruction, or removal of stream-crossing structures result in direct effects to water resources, but contract requirements (e.g., temporary stream channel de-watering, specific construction timing, and erosion control measures) are included to reduce fine sediment associated with these activities.

Published research has suggested that BMP upgrades such as those being implemented on the Bitterroot National Forest (e.g., gravel surfacing, reducing water travel distance on route prisms, and proper crossing designs) effectively reduce road surface erosion and sediment in nearby streams (Burroughs and King 1989, MacDonald and Coe 2008, Megahan and Ketcheson 1996, Seyedbagheri 1996) in *most* cases. Since 2001, the Bitterroot National Forest has increased the miles of road with aggregate surfacing and BMP-upgrades to reduce road effects on water resources (Chapter 3, Section 3.1.3 B). Bitterroot Forest Plan monitoring reports have reported a high level of implementation on planned road BMP upgrades and fish passage culvert projects {Project File folder ‘forest_plan_and_monitoring,’ Project File documents FPMON-033 to 036.pdf}. Bitterroot Forest Plan Monitoring Items 22 (Riparian Area Condition), 17 (Timber Sale BMP Reviews), 19 (Watershed Improvements) and 21/41 (combined PACFISH/INFISH Implementation and Effectiveness) show an active and successful program of sediment-reduction activities that includes emergency closures to protect water resources (Arrastra Creek OHV damage and rehabilitation, 2007), road decommissioning (Gilbert/Laird Road Decommissioning Project, 2007), BMP upgrades (Section 3.6.4 A – Effects Common to All Alternatives), Trailhead and parking area improvement (Piquette Creek Trailhead Rehabilitation, 2007), and fish barrier removal (Items 19 and 21/41, Forest Plan Monitoring Reports, {Project File documents FPMON-033 to 035.pdf }. Eighty fish barrier road crossings have been addressed since 2000 using both stream simulation crossing structures and culvert/crossing removals. Each of these stream simulation crossings and culvert removals includes improved road design, surfacing, and drainage through the crossing section to reduce sediment.

At this time, there are no designated motorized routes currently under an emergency closure status due to adverse motorized access effects. The most recent emergency closure was in 2009, on a road in the Threemile Creek drainage on the Stevensville Ranger District. While many designated motorized routes (roads and trails) display erosion effects, none are currently deemed serious enough to close the route using this emergency process. The Forest routinely closes new unauthorized routes, including signing and restoration, in an effort to minimize resource damage from OHVs {Project File folder ‘water_resources,’ Project File document WAT-004.pdf}. Several system routes, including Robbins Gulch Road #446, are temporarily closed using standard Forest Orders (Title 36 CFR 261.54(a) - Prohibitions in Areas Designated by Order -National Forest Roads) as needed during spring break-up, to reduce road damage and accelerated sediment delivery to the roadside stream channel.

Best management practices do not prevent adverse aquatic effects in all situations, such as where routes are immediately adjacent to streams, and little filtering vegetation is present, but they will reduce sediment volume. The Montana Department of Natural Resources and Conservation audits BMP implementation and effectiveness every two years; ratings for Federal lands (Forest Service and Bureau of Land Management) generally run from 85-90 percent for implementation success, and about 90 percent for effectiveness success (MT DNRC 2008, 2010). These results suggest that BMPs are an effective approach to minimizing road and trail-related sediment, but that in some cases, minor to moderate effects may still occur.

The Bitterroot National Forest has an active watershed program that stores and decommissions roads analyzed during vegetation treatment and watershed restoration projects, to reduce adverse watershed effects from the overall road system. The program focuses on watersheds with high road densities, 303(d)-listed streams and native fish populations, but also treats lower-priority sediment source areas when they coincide with other activities. Improved infiltration, soil stabilization and soil productivity and sediment reduction are common treatment goals. Since road building essentially ended in the late 1990s, approximately 195 miles of National Forest System roads have been placed into long-term storage, and 134 miles have been decommissioned and removed from the Forest's Transportation System (Chapter 3, Section 3.1-3, of this FEIS). In 2009, the Forest finished the decommissioning road work and had completed 25 fish passage crossing upgrades specified in the Burned Area Recovery Project (Project File document FPMON-035.pdf}, Monitoring Report – Item 17). Approximately 40 fish passage projects have been analyzed through the NEPA process and are waiting for funding {Project File document FPMON-035.pdf}. The Forest has been implementing three to four of these projects annually over the last several years {Project File documents FPMON-033 to 036.pdf}, Monitoring Reports - Items 17, 22). Additionally, many roads within 300 feet of streams receive aggregate surfacing to reduce erosion.

Levels of road and trail maintenance are largely based on Forest Service funding, and to some extent on volunteers for trails. Forest Service funding for maintenance is not projected to increase but to likely stay similar to current levels or decrease. Since FY 2010, approximately 20 percent of the open roads in the analysis area have received maintenance on an annual basis, but this is subject to funding variations. Maintenance addresses rutted running surfaces, lack of functioning water control devices (rolling dips, water bars, ditches, and cross drainage culverts), and the breakdown and loss of road and trail surfacing to reduce the risk of sediment reaching perennial streams. With the exception of ditch clearing, these practices generally reduce sediment (Luce and Black 2001). Standard maintenance measures used to protect water resources include gravel surfacing, cross-drainage improvement, and improving crossings. Maintenance priority is affected by assigned maintenance level, resource threats, and potential investment loss. Water resource protection on the Bitterroot National Forest focuses on detecting and fixing road segments that are producing elevated sediment levels. While most important road problems get fixed in a reasonable amount of time, minor problems may go extended periods without repair due to competition from other needs and a lack of staffing and budget.

Maintenance activities occur annually on approximately one-third of trails in the water resource analysis area. All system (designated) motorized and nonmotorized trails are on a survey and maintenance schedule, with the frequency of treatment based on a combination of factors including use, past maintenance needs, and environmental factors (e.g., heavy downfall, erosive soils, and running water). The trail crew routinely adjusts maintenance priority based on new trail condition information, including rutting, heavy erosion, and stream capture. The flexibility in this system is intended to give priority to those trail segments that need work to resolve erosion and sedimentation issues. Discussion with trail personnel suggests that this process successfully addresses the majority of safety and erosion problems with minimal time lag between discovery and remediation. Occasionally, trail rutting, erosion, poor drainage, and trail widening have occurred on some trail segments due to increased use, wet season use, maintenance schedule changes due to wildfires or other disruptions, and the lack of funding needed to address the entire trail maintenance backlog on a yearly basis. If trail conditions worsen, and erosion cannot be controlled through maintenance, an emergency closure of up to one year may be implemented to protect water, soil, and fisheries resources. The Forest Supervisor has the responsibility and authority under 36 CFR §295.5 to immediately close the road, trail, or area to use until the problem has been resolved. In a worst-case scenario, a proposal to close the trail to specific uses or to change access seasons would be sent out to the public and documented with NEPA procedures.

There are an undetermined number of miles of unauthorized routes on the Forest, which are being used primarily by ATVS and motorcycles. Unauthorized routes are not engineered or constructed to Forest Service standards. They are often located on steep grades or in boggy areas. Due to the lack of consideration for resource effects during their creation, most unauthorized routes are more prone to erosion and sediment production than system routes. However, the Forest Service cannot expend funds to maintain or improve unauthorized routes; maintenance and improvements are intended to ensure the integrity of travel routes. Consequently, conditions on these routes will continue to deteriorate as erosion creates deeper ruts and exposes more rocks, resulting in resource and safety concerns.

A program of closing and rehabilitating unauthorized OHV trails created after the 2001 Tri-State Decision has been ongoing. On the Bitterroot National Forest, 31 sites, many with multiple unauthorized trails, have had barriers and signs installed and disturbed soils treated to restore vegetation and reduce erosion {Project File folder 'water_resources,' Project File document WAT-004.pdf}. Not all of the sites have been within sediment-contributing distance of streams, but the activity ultimately benefits soil and water resources by limiting the proliferation of trails that are generally created without resource considerations.

## Timber Harvest, Prescribed Burning, and Associated Activities

Timber harvest has evolved from a highly driven process that provided little protection for other resources (e.g., water quality, wildlife, soils) to the current low level of selective harvest accomplished under an interdisciplinary framework. Water resource effects were drastically reduced from historic levels due to various regulations based on wildlife, water quality, and other natural resource issues. Recent projects on the Bitterroot National Forest have included precommercial thinning but no commercial harvest within INFISH RHCA buffer strips, which eliminates heavy equipment impacts in the area most likely to affect water resources.

Excluding roads use, neither the current levels of harvest or prescribed burn activities are substantial enough to be detrimental to water resources. Both of these activities have helped to reduce fuel loads and potential for future catastrophic wildfires.

Most water resource effects resulting from timber harvest are associated with timber hauling on roads within the 300 foot streamside zone and with road crossings. Sediment related to timber hauling starts declining immediately after hauling ends, although open streamside roads still produce sediment with recreational traffic. Best management practices are applied through timber sales to minimize timber haul effects, but roads created within 300 feet of streams often were designed without water quality consideration and therefore still have negative effects. These effects are discussed in more depth, under the topic of "Affected Environment – Transportation Systems", above. Road maintenance and its effects on sediment production are discussed below.

Sediment contribution from harvested sites sometimes occurs during large hydrologic events (e.g., intense thunderstorms and rain-on-snow events), but literature suggests these sediment events are rare where BMPs are followed (Megahan and King 2004). Temporary roads are almost always in upland sites, and are, with very few exceptions, not hydrologically connected to local streams. On the Bitterroot National Forest almost all recent harvest has been partial-cut or thinning prescriptions which leave standing trees and woody debris sufficient to minimize on-site soil erosion. Best management practices monitoring that focuses on unharvest filter strips (RHCA buffers) suggests that sediment transport through these buffers is rare {Project File documents FPMON-031, 034 and 036.pdf} (DNRC 2008, DNRC 2010) and harvest units themselves contribute either no or minor sediment to local water resources.

Prescribed burning used to manage vegetation generally creates little sediment risk, as it is applied within restricted conditions designed to minimize severe burning of soils and water quality impacts. Occasionally, severe burning consumes duff layers and causes physical damage to the surface mineral layers or creates a water repellant layer that impedes infiltration and creates surface conditions conducive to sediment production. These situations have been rare on the Bitterroot National Forest, although several prescribed fires have escaped and ended up causing substantial soil erosion in the last thirty years. Generally, herbaceous vegetation grows back after prescribed burns within a year, acting as an effective erosion control.

## Mining

Historically, mining was limited to a few small areas across the Bitterroot National Forest, and the water resource has seen only minor mining influence. In-stream mining (e.g., Hughes Creek) and upland mining (e.g., Stansbury vermiculite mine, Crystal Mountain mine) have both occurred infrequently in scattered areas.

## Cattle Grazing

Livestock grazing has occurred on what are now Bitterroot National Forest lands since the late 1800s. Livestock numbers have decreased over the years; in some allotments quite substantially.

Grazing-related contributions to sediment regimes vary with allotment but are usually minor, with some localized source areas reaching moderate levels. Those problem areas may affect water quality through increased fine sediment production, reduced shade, and altered riparian habitat. Some areas, such as Meadow Creek, have riparian fencing that has successfully reduced streambank erosion.

Adaptive management has addressed many riparian issues by adjusting the stocking, season, frequency, or timing of grazing, but localized “problem” areas still exist on some stream reaches.

## Wildfire Suppression

Fire suppression utilizes heavy equipment to scrape firelines free of flammable vegetation. This process creates areas vulnerable to erosion, and bare or disturbed soils get washed into streams during snowmelt or rainfall events.

Mitigation efforts include use of local Resource Advisors to assist with best fire line location and design, selection of low-impact methods or equipment, switching to hand line near streams and post-fire treatments to control erosion and unauthorized ATV traffic. Fire staff is routinely trained to consider environmental effects of suppression efforts, including ground disturbances. Sediment contribution to streams is minimized by these tactics and overall water resource effects of fire suppression are minor and short duration for most incidents.

## Motorized Wheeled Access for Dispersed Camping

Motorized access for dispersed camping purposes across the analysis area has steadily increased over the years, and is likely due to several demographic trends such as retirement of baby boomers or long-term trends of increased population in western states, but the level of increase on the Bitterroot National Forest is difficult to predict. Please see the Economic and Social analysis, Chapter 3, Section 3.4.3 B, Population, of this FEIS for discussion on demographic change occurring within Missoula and Ravalli counties. Section 3.4.3 G, Montana Trends in Motorized Use, further details a steady growth rate in ATV and motorcycle registrations.

Campsites next to streams are generally preferred for many reasons, including aesthetics, recreation, and ease of access for drinking or cooking water. Accessing these undeveloped sites with motorized vehicles creates a range of effects similar to road use near streams, depending on environmental variables and frequency of use. Most motorized access routes to dispersed camping areas have only minor water resource effects due to low slope angles and moderate use levels, but a portion of the existing motorized access routes are used at sufficiently high levels or have physical characteristics that affect nearby streams.

The most common water resource effects have been sediment-related, where physical characteristics and repeated use have combined to produce bare or disturbed soils that get washed into streams during melt or rainfall events. While the overall area of disturbance from motorized access for dispersed camping is relatively small on a 6th-level watershed basis, direct surface flow connections from the access route to the stream can produce localized fine sediment deposits in adjacent channels. Sediment production from motorized access routes to dispersed campsites varies greatly, depending on both amount of use and environmental factors. Higher sediment rates are associated with high use levels, increased slope angle, decreased vegetative buffers, natural drainage paths, nearby road drainage, and weak, coarse soils.

Water temperatures are unlikely to be affected by the small openings in riparian vegetation associated with motorized access to dispersed campsites. Published literature generally suggests that road and trail crossings (or crossing size openings) pose little risk, but that openings related to wildfires are more likely to raise water temperatures due the large expanses of shade-producing vegetation that can be affected. There is little evidence to suggest streamside camping or access route openings have accumulated to the point of having water temperature effects similar to these, or other large disturbances. Cutting vegetation to establish new motorized access routes for dispersed camping is forbidden by regulations designed to minimize resource damage, and is a citable offense.

Existing dispersed campsites typically have a suitable motorized access route commonly used to get to the site. The Forest has a continuing program of installing barriers to limit vehicle access or gravelling defined access routes where needed to reduce streamside impacts. A 2007 survey of dispersed camp sites on the Bitterroot National Forests suggests about 25 percent of such campsites are graveled, and about 12 percent are defined by boulders or a fence to protect nearby soil or water resources (Chapter 3, Recreation and Trails, Section 3.2.3 F). Skalkaho and Lost Horse Creeks are two popular dispersed camping areas where these methods have been used to protect water quality and fish habitat. These efforts have been mostly successful {Project File documents FPMON–022, 023, and 024.pdf}, Item 17), but short-term impacts from new sites or expansion at older sites occasionally occur before barriers can be installed. Also, riparian recovery can be slow due to ongoing foot traffic. Please see Fisheries and Aquatic Habitat, Chapter 3, Section 3.7.3, Affected Environment, for more discussion on motorized access for dispersed camping effects.

Overall, motorized wheeled access for dispersed camping activities tends to expand into new streamside areas over time, thereby slowly but continually increasing the risk to water resources. The Bitterroot National Forest's ongoing program to limit motorized access to dispersed camp sites where it causes soil and water resource problems is mostly successful, but can have a lag time between discovery and treatment. From personal and staff observations, it is believed that the level of risk is currently low for sanitation and temperature effects. Sedimentation risk is generally successfully minimized by through the use of BMPs (Project Design Features for Water Resources, Chapter 2, Table 2-19) on the cumulative effects analysis-area scale, but short-term variation occurs by 6th-level watershed and is related to both environmental variables and use levels. Dispersed camping effects are considered in the sediment model used to estimate and compare direct and indirect effects in 6th-level watersheds (Section 3.6.4 B), and cumulative effects on a larger scale.

## G. Integration of Effects

The existing condition of streams on the Bitterroot National Forest is an expression of the integrated natural and human effects within their watersheds. Those natural influences that affect sediment/siltation levels in analysis area streams include parent geology, wildfire, climate, extreme precipitation events, slope, and vegetative cover. Anthropogenic (human-caused) influences include building, use and maintenance of roads, timber harvest, recreation, prescribed or accidental fire, mining, and domestic grazing. Literature suggests road systems are a primary influence on stream health and habitat quality in forested watersheds through their sediment contributions (Sugden and Woods 2007, Megahan and King 2004, USDA Forest Service 2000a, and Furniss et al. 2000). Those watersheds where anthropogenic sediment sources are determined to prevent achievement of appropriate beneficial uses associated with water quality or stream habitat are considered "impaired," and are noted as such on combined Clean Water Act S303(d) and S305(b) lists, also known as the "Integrated Report." For the purposes of the effects discussion, the terms "impaired" and "listed" are used interchangeably. In Montana, the Department of Environmental Quality (MDEQ) has the responsibility for assessing water quality and beneficial use support and determining the Total Maximum Daily Load (TMDL) targets for each pollutant (e.g., sediment) needed to restore full beneficial use support in impaired streams. The Forest Service works with the MDEQ through a Memorandum of Understanding (MOU) to control non-point source pollution, achieve TMDL targets, and maintain Montana water quality standards.

Specific stream segments with contributing area on the Bitterroot National Forest have been listed by the MDEQ as not fully supporting pertinent beneficial uses due to sediment and siltation. The streams on the most recent (2012) list are noted below in Table 3.6-2, along with associated TMDL and water quality information.

***Table 3.6- 2: Bitterroot National Forest Streams Listed on the 2012 MDEQ 303(d) List for Sediment/Siltation***

| Waterbody | MDEQ Reach ID | Sediment TMDL and Date | Stream Miles Listed | Water Quality Classification |
|---|---|---|---|---|
| Ambrose Creek | MT76H004_120 | Mainstem – 2011 | 11.7 | 5 |
| Bass Creek | MT76H004_004 | Mainstem – 2011 | 5.1 | 5 |
| Bitterroot River | MT76H001_020 – Skalkaho to Eight Mile | Mainstem – 2011 | 36.5 | 5 |
| Bitterroot River | MT76H001_030 – Eight Mile to mouth | Mainstem – 2011 | 23.6 | 5 |
| Ditch Creek | MT76H003_060 | Headwaters - 2005 | 2.7 | 4A |
| Buck Creek | MT76H003_070 | Headwaters - 2005 | 2.5 | 4A |
| East Fork Bitterroot River | MT76H002_010 | Headwaters - 2005 | 29.9 | 5 |
| Gilbert Creek | MT76H002_080 | Headwaters - 2005 | 2.3 | 4A |
| Hughes Creek | MT76H003_040 | Headwaters - 2005 | 17.6 | 4A |
| Laird Creek | MT76H002_070 | Headwaters - 2005 | 5.7 | 4A |
| Lick Creek | MT76H004_170 | Mainstem – 2011 | 6.2 | 5 |
| Meadow Creek | MT76H002_030 | Headwaters - 2005 | 9.7 | 5 |
| Muddy Spring Creek | MT76H004_180 | Mainstem – 2011 | 2.0 | 5 |
| Overwhich Creek | MT76H003_050 | Headwaters - 2005 | 19.1 | 5 |
| Reimel Creek | MT76H002_020 | Headwaters - 2005 | 7.4 | 4A |
| Rye Creek | MT76H004_190 | Mainstem – 2011 | 5.6 | 5 |
| Sleeping Child Creek | MT76H004_090 | Mainstem – 2011 | 23.9 | 5 |
| Sweathouse Creek | MT76H004_210 | Mainstem – 2011 | 11.6 | 5 |
| Threemile Creek | MT76H004_140 | Mainstem – 2011 | 17.3 | 5 |
| West Fork Bitterroot River | MT76H003_010 | Headwaters - 2005 | 39.4 | 4A |
| Willow Creek | MT76H004_110 | Mainstem – 2011 | 16.3 | 5 |
| Total | | | 296.1 | |

More details on these listings can be found at the Montana Clean Water Act Information Center (CWAIC, http://cwaic.mt.gov/). Many of these waterbodies have reaches that meet Stream Class B-1 beneficial use standards (water from specific stream reaches can be used for their assigned beneficial uses such as cold water fisheries or full-contact recreation) (Montana ARM17.30.623), but the listing process often assigns impaired status to the entire length from the headwaters to the confluence with the next named stream, with exceptions for stream reaches in designated wilderness. Designated wilderness streams are generally considered as meeting MDEQ standards. Information on beneficial uses can be obtained at the following website: http://www.deq.mt.gov/wqinfo/Standards/default.mcpx. Water Quality Classifications indicate either a need for a TMDL ("5") or completion of all needed TMDLs ('4A"). All the streams listed have had sediment TMDLs completed, but those with a Water Quality Classification of "5" need additional TMDLs for other pollutants, such as nutrients.

Completed TMDLs allocate the maximum "load" of a pollutant to the existing sources that will allow for full beneficial use support. In the Bitterroot River watershed TMDL assessments, the main sediment sources were determined to be unpaved roads and streambank alteration from various land uses. Regardless of the Water Quality Classification, the Forest Service has a responsibility to consider, and where appropriate, minimize sediment effects, to the extent practical, in sediment-impaired or listed watersheds. Watershed improvement activities are suggested within the TMDL documents to improve beneficial use support. Suggested remediation is voluntary, and includes using native-surface road BMPs rather than road closures to meet sediment TMDLs. Details can be found on the MDEQ TMDL websites: http://deq.mt.gov/wqinfo/TMDL/finalReports.mcpx, and http://deq.mt.gov/wqinfo/tmdl/default.mcpx. Increases in the motorized route system within watersheds with sediment-impaired streams were carefully considered during development of the Travel Management Planning Project, since these stream reaches are considered more sensitive to sediment increases than other, non-listed streams.

A stream's listing as impaired in the 305(b) Integrated Report does not keep management activities from taking place, but does add certain conditions. Montana Code Annotated (MCA) 75-5-703(10)(c), states: "(10) Pending completion of a TMDL on a water body listed pursuant to 75-5-702: (c) new or expanded non-point source activities affecting a listed water body may commence and continue their activities provided those activities are conducted in accordance with reasonable land, soil, and water conservation practices." In other words, land management proposals in watersheds with impaired streams need to incorporate reasonable actions to reduce non-point source pollutants (e.g., sediment) and improve overall watershed conditions. MDEQ has a TMDL implementation monitoring process that rates watershed restoration plans for effectiveness that encourages addressing pertinent watershed problems. How the various action alternatives act to improve or maintain beneficial use support is included in Environmental Consequences Sections 3.6.4 A and B, and in Cumulative Effects section 3.6.4 C.

## 3.6.4 Environmental Consequences

### Summer

### A. Effects Common to All Action Alternatives

All action alternatives keep many miles of roads and trails open to motorized vehicles on the Bitterroot National Forest landscape. Known aquatic or water resource adverse effects associated with roads are:

- Roads directly and indirectly contribute more sediment to streams than any other land management activity.
- Loss of State-assigned beneficial uses can result from poorly planned, designed, located, constructed, or maintained roads.
- Roads have the potential to affect water quality through applied road chemicals and toxic spills.
- Roads can directly affect natural sediment and hydrologic regimes by altering streamflow, sediment loading, sediment transport and deposition, channel morphology, channel stability, substrate composition, stream temperatures, water quality, and riparian conditions within a watershed.
- Poor road location, concentration of surface and sub-surface water by cross-slope roads, inadequate road maintenance, undersized culverts, and side-cast materials can lead to road-related mass failure movements.

- Ø Road/stream crossings can be a major source of sediment to streams resulting from channel fill around culverts and subsequent road crossing failures (Quigley et al. 1997).

The action alternatives (**Alternatives 1, 3** and **4**) share several factors, and therefore several associated direct and indirect effects, for water resources. These factors include both project design features and contextual details within which they would occur. The first four following factors and their noted effects would be the same for all action alternatives, and the rest for all alternatives. The first ten are all factors that help mitigate the adverse effects listed above.

1. (**Alternatives 1, 3** and **4**) Use of a 30 foot "No drive zone" around flowing streams, ponds, lakes, marshes, and wetlands for motorized wheeled access for dispersed camping. This protective measure does not include designated routes, but would reduce vehicle-related soil and vegetation disturbance off of motorized routes in the sensitive area next to these water features, and therefore reduce sediment production and help maintain stable streambanks and lake shores. The buffer would likely benefit all waterbodies with adjacent existing or potential new sites.
2. (**Alternatives 1, 3** and **4**) Designation for parking motorized vehicles off of designated routes within 30 feet from the edge of the route surface when not accessing dispersed campsites. Limiting non-camping motorized access to an area close to the road would reduce soil disturbance when compared to **Alternative 2**. (**Alternatives 1, 3** and **4**) Almost all unauthorized routes still existing under the 2001 Tri-State Decision would be closed to motorized use with the Travel Management Planning Project decision, with **Alternative 4** closing more mileage {Project File folder 'water_resources,' Project File document WAT-005.pdf}. Unauthorized routes closed to motorized use in any alternative would be physically rehabilitated as needed, within budget and staffing capability. They would not be automatically converted to system trails for nonmotorized use, which would allow for natural recovery, soil stabilization, reduced sediment risk, and a reduction in cumulative effects. Motorized access for dispersed camping associated with these routes would also be eliminated, further reducing sediment risk.
3. (**Alternatives 1, 3** and **4**) Any OHV route "connectors" proposed for implementation in this project would undergo additional analysis, design, and NEPA documentation of effects before ground disturbance begins. Resource protection through planning, design, and construction BMPs would be included. This approach would minimize water resource effects from these new trail segments.
4. (**All alternatives**) A successful water resource effects mitigation program that uses physical barriers to limit motorized access near water resources and on sensitive terrain or soils would continue. Observed conditions at sites where this has been applied (e.g., Skalkaho, Lost Horse, and Tin Cup Creek watersheds) suggests that the barriers are successful in limiting motorized travel impacts such as soil displacement, rutting, and erosion. While the program is considered effective, there are some sites that require repeated treatments or still contribute a reduced level of sediment due to nonmotorized disturbances such as camping activities, or difficult revegetation conditions.
5. (**All alternatives**) Watershed restoration and sediment-reduction projects would continue to be proposed through appropriate processes, supporting finished sediment TMDLs, fish habitat and road maintenance cost reduction goals, and reducing effects from other activities such as timber harvest. The sediment-reduction goals of these projects may be measureable at the 6th-level watershed scale if their activities are robust enough. In any alternative, future projects may implement sediment-reduction activities such as motorized route BMP upgrades, storage, change in motorized access, or closure and decommissioning, any of which could reduce sediment risk in those watersheds where the action is proposed.
6. (**All alternatives**) A road maintenance program that focuses on reducing road system effects to water resources by implementing BMPs such as gravel surfacing, improved cross-drainage, and minimizing water travel distances on road prisms would continue. Recent BMP projects include Road #75 (Skalkaho-Rye), Road #5627 (Little Trapper Creek), Road #428 (Ambrose Creek) and Road #370 (Warm Springs – Laird Creek). See Chapter 3, Section 3.1.3 B (Operation and Maintenance) for more detail on non-point pollution control measures on streamside roads.

7. (**All alternatives**) Existing resource protection regulations that have evolved over time, and are heavily influenced by the 1987 Forest Plan, 1995 INFISH Forest Plan Amendment, and the 2001 Tri-State Decision would continue. Resource protection measures (Project Design Features) applicable to each alternative are listed in Chapter 2, Table 2-19, of the FEIS. Those that pertain to **Alternative 2** are currently being used to protect water resources. All existing protections would be brought forward regardless of the alternative selected, and several would be added for **Alternatives 1, 3,** and **4**.
8. (**All alternatives**) The Bitterroot National Forest currently has a field-going (summer) OHV Ranger who reduces resource damage by contacting, and when needed, warning or citing (ticketing) OHV users who violate the above-noted resource protection regulations. This program has been very successful in helping Forest users understand and follow travel management regulations and reducing resource damage. This program would continue, as funding allows, with all alternatives.
9. (**All alternatives**) The predicted short-term (within 10 years) increase in the use of motorized routes of the Bitterroot National Forest (please see the Recreation and Trails, and Economics and Social analyses on this topic, Chapter 3, Sections 3.2 and 3.4, respectively) is considered in all alternatives, as is the potential "shift" (displacement) of motorized users from one trail to another due to changed access. The motorized use growth rates are not entirely predictable as they are influenced by external factors such as the national economy and fuel prices, and therefore the actual growth in motorized recreation and related effects will vary somewhat. Increases in motorized use during the life of the travel plan is addressed by using a "worst case" effects analysis scenario for the alternatives, which would address possible short-term increases in motorized use or sediment. Longer-term changes (greater than 10 years) are more difficult to predict, although adaptive management practices are in place to mitigate effects. Additionally, the current practice of motorized route monitoring by the Trails and Engineering Shops will continue. The most likely long-term (greater than 10 years) trend is for motorized recreation to continue growing, increasing disturbance levels on trails open to motorized access.
10. (**All alternatives**) Up to forty-two campsites outside of the 300 foot (Alternative 4) or 600 foot corridor (**Alternatives 1, 2** and **3**) for motorized wheeled access for dispersed camping off designated routes would remain open under all alternatives {Project File folder 'dispersed camping,' Project File document DISP-001.pdf}. Motorized access for dispersed camping project design features (physical barriers, "no-drive" zone) would be applied as needed at these sites to protect water resources (Chapter 2, Table 2-19, of this FEIS). Due to their relatively small number, scattered locations, and well-established access, these sites are not causing watershed-scale problems, although some of the sites may be contributing minor amounts of sediment during precipitation or snowmelt events. These sites are currently monitored for resource damage, and would continue to be under all alternatives.
11. **All Alternatives** would allow motorized wheeled access for dispersed camping off of designated routes, though the distance a vehicle is allowed from the designated route would vary by alternative. Several factors suggest a range of minor-to-moderate future increases in motorized access for dispersed camping and associated effects to water resources.

Most sites that have desirable campsite characteristics have already been established, limiting future increases in the number of motorized routes to access them. Expansion of new and existing sites is expected, but would likely be limited by terrain features including narrow stream canyons, steep inner gorge slopes, standing and down trees, large rocks, thick vegetation, abrupt topographic changes, and water features in most locations, and by citable regulations against resource damage in others. Existing dispersed sites typically have a developed motorized access route that is the most suitable and most commonly used route to the camp site. The Forest will continue to monitor the emergence of new dispersed sites that are accessed by motorized vehicles, as well as changes at existing sites. The Forest will alter or close sites where motorized access routes result in excessive disturbance to water resources.

The total number of sites used for dispersed camping, and associated motorized routes, is expected to increase gradually over time. Firewood cutting following beetle or fire events is expected to open up more access routes to dispersed camp sites, but cutting firewood within 150 feet of streams, wetlands, or lakes, or skidding trees across these features, is illegal, which would limit new sites near streams. Once established, sites continue to be used, a process leading to growth in the number of sites. Certain wide, flat stream valleys such as Hughes, Slate, Lost Horse, Threemile, and Skalkaho Creeks are more accessible, and greater expansion (and more riparian impact) was considered at this type of site when analyzing effects of alternatives. Monitoring at these sites will determine the point at which the Bitterroot National Forest acts to limit further expansion.

The overall increase in the effects of motorized wheeled access for dispersed camping is expected to be limited to moderate levels by limitations imposed by natural obstacles, the existing program of physically limiting motorized access to stream banks, and regulations against resource damage.

12. (**All alternatives**) Existing system routes closed to motorized use would still be open to pedestrian, horse, and in many cases, mechanical transport use. For all trails closed to motorized access under the Travel Management Planning Project, the route would remain on the landscape, and other uses or travel modes would continue to create some level of soil disturbance. For those trail segments within 300 feet of streams, there would still be some potential for surface water flow events to transport sediment to the stream. The degree of sediment reduction from a route closed to motorized access depends on subsequent nonmotorized use, maintenance, environmental factors, and whether a physical treatment is proposed in later projects. Please see discussion in the Measurement Indicator section, above, for more information.
13. (**All alternatives**) Private and State land activities would not be affected by the project decision, and would continue. Since this project has no jurisdiction over these lands, any activities occurring or planned (and their effects) would continue and be similar for all alternatives.

Factors 1 through 11, above, are considered favorable to reducing sediment and therefore protecting water resources within the project area. They help reduce the effects of legal motorized access by reducing resource damage such as rutting, compaction, and vegetation destruction, and by preventing unauthorized routes. All alternatives occur under this framework of protective measures (including factors 1 through 11, above) designed to protect water (and many other) resources. Many measures are enforced with potential citations and associated fines. Factors 12 through 13 will be monitored for trends and associated sediment reduction activities will continue to be considered as needed in the future.

## B. Direct and Indirect Effects

This section describes potential direct and indirect water resource effects associated with the alternatives using information from the measurement indicator (3.6.1 A) and Affected Environment (3.6.3) sections. Effects analysis assumes motorized use on specific route segments that cross or run near streams increases risk for adverse sediment-related direct and indirect effects to beneficial uses and aquatic values, and that reducing motorized use on these segments would reduce the risk for the same effects. The total potential motorized sediment indicator represents activities that produce both direct (stream channel or bank disturbance) and indirect (connected off-channel disturbance and erosion) effects. Risk of adverse sediment effects is considered to be greater in sediment-impaired or listed streams (Table 3.6-2), and also with $6^{th}$-level watershed indicator values over 10 percent of natural background levels (Jordan 2006).

Direct and indirect effects are considered by $6^{th}$-level watersheds within the Montana portion of the Bitterroot National Forest; motorized access in the Idaho portion of the Forest, including the Magruder Corridor, is controlled by wilderness legislation, and would have no motorized access changes due to this project. **Alternatives 1, 3,** and **4** differ in where motorized access changes from the existing condition (**Alternative 2**) are proposed, and each alternative has $6^{th}$-level watersheds with no proposed motorized access changes. Those $6^{th}$-level watersheds that have no proposed changes in a given alternative are not discussed in detail, as that alternative would not affect water resources when compared to the existing condition (**Alternative 2**). Please see discussion in **Alternative 2** – Existing Condition, for details on how a No-Action scenario affects water resources. Cumulative effects are defined and discussed in Section 3.6.4 C, including off-forest sediment effects.

The comparisons between "action" **Alternatives 1, 3** and **4**, and the existing condition (**Alternative 2**) are the absolute changes in the indicator rather than the relative change, except where specifically noted. For example, a change in the indicator for a specific 6th-level watershed from one percent to five percent is noted as an increase in four percentage points, rather than the relative change of four hundred percent. Relative change is discussed in some examples to better describe the magnitude of the proposed changes.

## Comparison of Action Alternatives

The Purpose and Need for this project includes "Integrate resource considerations into the route system." This was done by considering the effects motorized access has on water resources, and proposing changes to reduce sediment risk where appropriate. To determine how each alternative meets the project objectives, the changes in the indicator for 6th-level watersheds were compared between **Alternatives 1, 3, and 4** and **Alternative 2** in Table 3.6-3, below. {Project File document WAT-006.pdf} lists all 6th-level watersheds affected by the alternatives and their 303(d) list status for **Alternative 2** (Existing Condition).

***Table 3.6- 3: Direction of Change in 6th-level Watershed Risk Indicator from the Existing Condition (Alternative 2), with Selection of Alternatives 1, 3, or 4***

| | Alt. 1 | Alt. 3 | Alt. 4 |
|---|---|---|---|
| Watersheds with 303(d) Streams - Reduced Risk Indicator | 11 | 4 | 22 |
| Watersheds with 303(d) Streams - Unchanged Risk Indicator | 14 | 20 | 3 |
| Watersheds with 303(d) Streams - Increased Risk Indicator | 0 | 1 | 0 |
| Full Beneficial Support Watersheds with Reduced Risk Indicator | 15 | 6 | 31 |
| Full Beneficial Support Watersheds with Unchanged Risk Indicator | 34 | 35 | 18 |
| Full Beneficial Support Watersheds with Increased Risk Indicator | 0 | 8 | 0 |

### *Alternative 1*

Table 3.6-3; see also {Project File folder 'water resources,' Project File document WAT-006.pdf} displays results from the 6th-level watershed total potential motorized sediment analysis for **Alternative 1**. Results suggest no change from the existing condition (**Alternative 2**) in motorized sediment risk for 14 watersheds with 303(d)-listed streams, and decreases for the remaining 11 if **Alternative 1** is chosen. The 14 watersheds that do not show a change in the indicator are not likely to see changes in water resource condition or beneficial use support on Forest Service Lands from implementing **Alternative 1,** suggesting that the Forest's motorized route influence on their impaired status would be the same as in **Alternative 2**. Analysis results suggest 11 6th-level watersheds with sediment-impaired streams (Lower Burnt Fork Bitterroot River, East Fork Bitterroot River-Jennings Camp Creek, Meadow Creek, Hughes Creek, Overwhich Creek, West Fork Bitterroot River-Beaver Creek, West Fork Bitterroot River-Mud Creek, West Fork Bitterroot River-Lloyd Creek, Sweathouse Creek, Threemile Creek, and Upper Sleeping Child Creek) would see reductions in total motorized sediment risk from 1 to 5 percentage points of background levels from the existing condition (**Alternative 2**). For an explanation of the interpretation of percentage changes, please refer to page 8, Section 3.6.1 A (Effects Estimation and Comparison) of this document. Changes of this magnitude are likely to be observable at the source areas, but may not be measureable at the 6$^{th}$-level watershed scale (at the watershed outlet) (Jordan 2006). Since the predicted change noted above is a reduction in sediment, conditions at the source areas (motorized route stream crossings, channel reaches with parallel motorized routes within 300 feet, or motorized access for dispersed camping within 300 feet of water resources, as described in Section 3.6.1A) would improve in their support for the beneficial uses of cold water fishery, aquatic life, and full-contact recreation and in general channel condition (percent of fine sediment in the stream bottom). Of those 11 6$^{th}$-level watersheds with 303(d)-listed streams with reductions in the indicator, the reduction in motorized access would directly improve local channel conditions in the 303(d)-listed stream in nine of them by reducing sediment (see details on the exception for Muddy Springs Creek, below).

If enforcement and environmental variables are considered constant across the various alternatives (e.g., enforcement success and hydrologic or runoff events would be similar regardless of which alternative is chosen), the amount of improvement realized in any given 303(d)-listed stream is dependent on the magnitude of the change in motorized access. Improvements in Threemile Creek will be observable at the source areas, as the change in total potential motorized sediment is from closing a 0.2 mile riparian segment of Road #640, which would improve vegetative cover on the old roadbed within 300 feet of the stream, reduce motorized access for dispersed camping effects, and reduce sediment potential during surface flow events. A stream reach in the Upper Sleeping Child 6$^{th}$-level watershed would also benefit from the closure of a segment of Road #62766 within 300 feet of the stream, including a native soil ford which is likely to re-vegetate and stabilize without motorized use. The stream channel and immediate downstream reaches would benefit from the sediment reduction of closing the ford and parallel roadway, although beneficial changes in the overall sediment regime for this stream may not be measureable against the total background sediment. In the Lower Burnt Fork – Bitterroot River 6$^{th}$-level watershed, reductions in the total potential motorized sediment indicator suggest **Alternative 1** would reduce sediment risk in the Burnt Fork itself but are not likely to affect the 303(d)-listed stream in the watershed (Muddy Springs), as none of the changes occur within its sub-watershed area. Sediment in Muddy Springs is related to grazing practices, which were changed several years ago by fencing the spring area, and changing management in the rest of the allotment. **Alternative 1** would reduce sediment risk in specific stream reaches of Meadow Creek due to a reduction of about 2.4 miles of motorized use within 300 feet of streams on Trails #170 and #172, and two motorized trail stream crossings. Related changes in sediment production are not likely to be measureable at the 6$^{th}$-level watershed scale, however, due to the relatively small two percentage point change in the indicator for Meadow Creek.

For other listed stream reaches, analysis results suggest East Fork Bitterroot River-Jennings Camp Creek, Hughes Creek, Overwhich Creek, West Fork Bitterroot River-Beaver Creek, West Fork Bitterroot River-Mud Creek, Sweathouse Creek and West Fork Bitterroot River-Lloyd Creek 6$^{th}$-level watersheds would all have a one percentage point reduction in overall motorized access-related sediment risk with **Alternative 1,** when compared to background sediment levels. The proposed changes in motorized access would benefit channel conditions in limited, specific stream reaches and crossings, but are not likely to be detected at the 6$^{th}$-level watershed scale. Likely benefits include reduced fine sediment in adjacent channel reaches and improved bank stability at affected stream crossings.

Table 3.6-3 {Project File folder ‘water_resources,’ Project File document WAT-006.pdf} also lists results for all 6$^{th}$-level watersheds without 303(d)-listed streams. Thirty-four 6$^{th}$-level watersheds would have no change from the existing condition (**Alternative 2**), and are predicted to maintain their current total potential motorized sediment risk if **Alternative 1** is implemented. All are 6$^{th}$-level watersheds rated by MDEQ as currently supporting all beneficial uses, which suggests they would continue to support these beneficial uses with the selection of **Alternative 1**. Due to the lack of effects on these streams, they are not discussed further. Fifteen other 6th-level watersheds lacking impaired streams in Table 3.6-3 are predicted to experience reductions in total motorized access sediment risk from one to nine percent of background levels due to reductions in motorized access. The streams in these watersheds currently support all beneficial uses and would be expected to continue to do so if **Alternative 1** was chosen. As with the impaired streams discussed above, a change of this magnitude (from one to nine percentage points of background levels) is likely to be observable and beneficial at the source areas, but may not be measureable at the watershed outlet (Jordan 2006). 6th-level watersheds with large reductions in the indicator include Upper Blue Joint Creek (nine percentage points), Sheephead Creek (six percentage points), and Upper Burnt Fork Bitterroot River (five percentage points). All of these larger changes are due to reductions in motorized access on single-track trails within 300 feet of streams, and a reduction in the number of stream crossings {Project File document WAT-006.pdf, Table 3.6-3}.

**Alternative 1** proposes closing approximately 14.6 miles of unauthorized routes within 300 feet of streams {Project File document WAT-005.pdf} to minimize resource effects, rather than converting them to system trails. Due to a lack of consideration for resource effects during their creation, most unauthorized routes are more prone to erosion and sediment production than system routes. For this reason, closing unauthorized routes that would not be converted to system routes is an important step in reducing sediment risk to water quality and beneficial uses. This change in motorized routes is included in total motorized sediment risk analysis summarized in {Project File document WAT-006.pdf, Table 3.6-3}, and in the above discussions for 6th-level watersheds with and without 303(d)-listed streams. **Alternative 1** also proposes to build a new "connector" trail for ATVs 50 inches or less in width in the Threemile Creek watershed, with one new stream crossing and approximately 0.14 miles (about 740 feet) of which is within 300 feet of a stream channel. This disturbance is included in the total potential motorized sediment estimation, which suggests a net decrease of about 3 percent of background sediment in motorized access-related sediment from the existing condition (**Alternative 2**). The proposed new motorized trail's construction details will be included in a separate analysis, but initial field reviews suggest there are no unique hazards or special water resource issues that cannot be mitigated with proper trail BMPs and consideration of water resources during the design, layout, and implementation phases of construction {Project File folder 'soils,' Project File document SOILS-005.pdf}; {Project File folder 'trail_313_connector,' Project File documents TR_313-001.pdf and TR_313-002.pdf (photographs)}.

**Alternative 1** proposes to designate about 30 miles of unauthorized routes on the MVUM. About 18 miles would be proposed to be designated as ATV trails seasonally; approximately 1 mile would be designated to be open yearlong. Some of these routes would connect existing roads.

Approximately 10 miles of the routes proposed to be designated for ATVs would not be shown on the MVUM until separate site-specific NEPA analysis and decisions, associated with relocating the routes to more sustainable locations to address rutting and erosion concerns, are completed and they exist on the ground.

Additionally, 11 miles of unauthorized routes would be proposed to be designated for use as motorcycle trails: 10 miles would be open seasonally, and 1 mile would be open yearlong {Project File folder 'unauthorized_trails,' Project File document UAT-003.pdf}.

Once unauthorized routes are designated, the Forest Service would be able to expend funds on them for maintenance and improvement, which are intended to ensure the integrity of travel routes. Consequently, conditions on the routes would improve, as ruts would be bladed, reducing erosion and sedimentation.

For a listing of the unauthorized routes proposed to be designated on the MVUM for **Alternative 1**, please refer to Appendix K to the FEIS.

**Alternative 1** proposes to prohibit mechanical transport within 1987 Forest Plan recommended wilderness areas, but not in Montana Wilderness Study Act (MWSA) areas. Observed effects that were tied to mechanical transport use during field review included minor rutting from wet trail use, minor channel disturbance at stream crossings, and some skidding/erosion on steep trail segments. Mechanical transport use appeared to create some sediment source areas that, due to the low intensity of effects and the limited area affected, would not have measureable effects at the 6th-level watershed or stream reach scale. Literature reviewed in Section 3.6.1. A suggests this type of use would likely have only minor watershed-level effects in the future, even with foreseeable moderate increases in this activity's volume. This information suggests **Alternative 1** would have minor water resource effects from mechanical transport use as noted above within MWSA areas, but water resources within the 1987 Forest Plan recommended wilderness areas would see a minor decrease in the same effects. Changes in mechanical transport access were not included in the water resource measurement indicator (Section 3.6.1 A).

Overall, analysis results suggest **Alternative 1** would reduce motorized access sediment risk in eleven sediment-impaired 303(d)-listed streams by reducing the number of stream crossings and length of motorized routes within 300 feet of streams, thereby promoting net reductions in total potential motorized sediment, and maintaining the current level of sediment risk in 14 others when compared to the existing condition (**Alternative 2)**. Those watersheds with reductions in the total potential motorized sediment indicator are predicted to have lower risk for motorized access-related disturbance and sediment, while those with no change would remain similar to current conditions. No watersheds with listed streams would have increased sediment risk under this alternative. All 49 $6^{th}$-level watersheds that do not have streams listed for sediment impairments would have a reduction or no change in predicted total potential motorized sediment from implementing **Alternative 1**; these watersheds are highly likely to maintain current full beneficial support status as there is either a reduction or no change proposed in motorized access or associated effects. Resource protection efforts noted in 3.6.4 A (Common to All Action Alternatives) would be carried forward with any alternative to minimize motorized access resource damage.

***Alternative 2 – No Action***

The existing effects of roads and trails on water resources are described in Section 3.6.3 (Affected Environment).

This alternative would make no changes to motorized access, and would maintain the status quo for water resources. Unauthorized routes created before the 2001 Tri-State Decision would continue to be open to motorized use, and later unauthorized routes would not. Sediment and channel impacts from the motorized route system and motorized wheeled access for dispersed camping would continue at their current levels, and likely increase with the trend towards increased recreational use, unless other activities to change the situation were proposed at a later date. Streams would most likely maintain their current levels of beneficial use support (or non-support) over the next 10 years; those streams on the MDEQ 303(d)-list for sediment impairment (Table 3.6-2) would retain their current motorized access sediment risk and likely their beneficial use support level on-Forest. The existing condition described in the Affected Environment (3.6.3) would likely continue over the short term (10 years) with **Alternative 2**.

Table 3.6-4 in {Project File folder 'water resources,' Project File document WAT-006.pdf} displays all $6^{th}$-level watersheds and their measurement indicator values for **Alternative 2**. {Project File folder 'water resources,' Project File document WAT-001.pdf} displays the number of road and trail stream crossings and the length of motorized routes within 300 feet of streams for each $6^{th}$-level watershed. With **Alternative 2**, direct effects (stream channel and bank disturbances) and indirect effects (sediment contribution) would continue at those channel locations currently being affected by motorized use, and if motorized use increases with time as predicted, effects would likely also increase. Two sediment-impaired watersheds have measurement indicator results of zero (Bitterroot River-Larry Creek and Bitterroot River-Spooner Creek) due to little of their area being on Forest, and a lack of motorized routes within 300 feet of streams within the National Forest System lands portions of the watersheds. The existing condition of these watersheds has not been affected by National Forest motorized access in the recent past, and would not be in the near future. Measurement indicator (total potential motorized sediment-percent of background) values for the remaining 23 watersheds with 303(d)-listed streams range from 2 to 12 percent.

The Upper Sleeping Child 6th-level watershed indicator value is twelve percent, and Ambrose Creek is 11 percent, which suggests a higher risk level for sediment-related motorized access effects, and the possibility of motorized-access-related sediment reaching measureable levels at these 6th-level watershed outlets. All other 6th-level watersheds with listed streams have indicators below eight percent, suggesting direct and indirect effects are currently limited to sediment source areas (stream crossings and parallel route segments within 300 feet), and short reaches of adjacent stream channel.

Growth in forest use, and specifically motorized use, is discussed in the Effects Common to All Alternatives (3.6.4 A), Cumulative Effects (3.6.4 C), and the Recreation and Trails section of the FEIS (Chapter 3, Section 3.2). Growth is likely to occur regardless of the alternative chosen, with outside influences (e.g., national economy and fuel prices) influencing growth rates. Those routes currently open to motorized use are likely to see more use, more erosion, and therefore, more sediment production over time, increasing the risk of related adverse sediment effects. See the Effects Common to All Alternatives section (3.6.4 A) for design features that decrease sediment related to motorized use. Increased use of these BMPs and other measures would tend to reduce the risk for direct and indirect effects, but would not wholly eliminate them. Resource protection efforts noted in 3.6.4 A (Common to all Action Alternatives) would be carried forward with any alternative to minimize motorized access resource damage.

**Alternative 2** would not designate any authorized routes on the MVUM. Consequently, the Forest Service would not be able to expend funds to maintain or improve unauthorized routes; maintenance and improvements are necessary to address accelerating erosion and sediment delivery. Conditions on the routes would continue to deteriorate, as erosion creates deeper ruts and exposes more rocks, resulting in increased sediment production.

**Alternative 2** would not restrict mechanical transport (bicycles) within the MWSA and 1987 Forest Plan recommended wilderness areas. Observed effects that were tied to mechanical transport use during field review included minor rutting from wet trail use, minor channel disturbance at stream crossings, and some skidding/erosion on steep trail segments. Mechanical transport use appeared to create some sediment source areas that, due to the low intensity of effects and the limited area affected, would not have measureable effects at the 6th-level watershed or stream reach scale. Literature reviewed in Section 3.6.1 A suggests this type of use would likely have only minor watershed-level effects in the future, even with foreseeable moderate increases in the volume of activity. This information suggests the continuation of mechanical transport use in **Alternative 2** would have minor water resource effects as noted above. Changes in mechanical transport access were not included in the water resource measurement indicator (Section 3.6.1 A).

### *Alternative 3*

Table 3.6-3, see also {Project File folder 'water resources,' Project File document WAT-006.pdf, Table 3.6-5} displays results from 6th-level watershed total potential motorized sediment analysis for **Alternative 3,** along with the estimated percent of background sediment for the alternative and the change in percent of background from the existing condition. Analysis results suggest **Alternative 3** would reduce total potential motorized sediment risk in four 6th-level watersheds with 303(d)-listed streams (West Fork Bitterroot River – Loyd Creek, Hughes Creek, Meadow Creek, and West Fork Bitterroot River – Beaver Creek). If **Alternative 3** were chosen, the measurement indicator would not change from current conditions in 20 6th-level watersheds with 303(d)-listed streams. This implies that stream channel conditions in the National Forest System lands portions of these watersheds would remain similar to the existing condition (**Alternative 2),** with no change to the channel conditions, impaired status, or beneficial use support. One 6th-level watershed with a listed stream (Bass Creek) would see an increase of two percent of background, from two to four percent, if **Alternative 3** is chosen. This small increase (and small total) in the measurement indicator suggests that the increase in motorized access may create sediment source areas that are observable (e.g., increased erosion and fine sediment at stream crossings), but the effects are unlikely to be measureable downstream.

Table 3.6-3 also displays changes in the effects indicator for non-303(d)-listed streams, which are currently meeting beneficial use standards. The total potential motorized sediment-percent of background decreases from the existing condition for six 6th-level watersheds, remains the same as the existing condition (**Alternative 2**) in 35 others, and increases in the remaining eight. Results suggest those watersheds with a decrease or no change in the indicator would maintain their current good levels of water quality and beneficial use support, as motorized access effects would either decrease or remain similar to those currently occurring. The $6^{th}$-level watersheds with increases are considered below in more detail, as the increase in sediment risk from implementing **Alternative 3** increases the potential to negatively affect water resources.

Analysis results suggest Mill, Boulder, Trapper, Sawtooth, Tin Cup, Watchtower, South Lost Horse, and Blodgett Creek $6^{th}$-level watersheds would experience increases in motorized access-related sediment risk from implementing **Alternative 3**, with increases from one to eight percentage points of background sediment over the existing condition (**Alternative 2**). Jordan (2006) suggests sediment regime changes of this magnitude are likely to be observable at the source areas, but not likely to be measureable at the $6^{th}$-level watershed scale (at the watershed outlet). Blodgett Creek would have the largest increase in the percent of background sediment indicator, from one to nine percent. Blodgett Creek water resources with increased risk include the channel and streamside riparian areas from the trailhead near the Forest boundary, to the Selway-Bitterroot Wilderness Boundary, where motorized access would end. Table 3.6-5 in {Project File folder 'water resources,' Project File document WAT-006.pdf} displays an increase in the indicator from two to six percent for South Lost Horse $6^{th}$-level watershed with **Alternative 3.** This level of increase would produce similar effects to those noted for Blodgett Creek, likely increasing sediment source areas but not substantially affecting overall sediment increases in the $6^{th}$-level watershed.

Trapper, Mill, Boulder, Sawtooth, Tin Cup, and Watchtower Creek $6^{th}$-level watersheds are predicted to have both minimal increases (from one to three percent points of background sediment) and low resulting totals (from one to seven percent of background), which suggests **Alternative 3** would not create measureable increases in total $6^{th}$-level watershed sediment over the existing condition (**Alternative 2**), but that new source areas for sediment would be observable. Source-area effects such as channel disturbance at motorized route stream crossings and fine sediment increases in channel reaches immediately downstream of crossings, adjacent to parallel motorized routes, and motorized access corridors for dispersed camping within 300 feet of streams, are the potential impacts on these streams from implementing **Alternative 3.** The duration of the effects would be as long as the routes are open and used for motorized recreation access.

**Alternative 3** would close the same amount of unauthorized routes within 300 feet of streams to motorized use as **Alternative 1** {Project File document WAT-005.pdf}, with the same potential to create beneficial effects in those $6^{th}$-level watersheds. This activity is included in the calculation of total potential motorized sediment and the net change for each $6^{th}$-level watershed. For potential effects of these closures, please see the discussion for **Alternative 1**, above. The general result of closing unauthorized routes within 300 feet of streams is a reduction in sediment risk and an improvement in stream health over the existing condition (**Alternative 2**). **Alternative 3** also proposes to build a new "connector" road prism in the Threemile Creek watershed, but there would be no new stream crossings or trail segments within 300 feet of streams. This new road segment is proposed to be open seasonally to motorized vehicles 50 inches in width or less and available for administrative access by full-size vehicles. The proposed new motorized route's construction details will be included in a separate analysis, but initial field reviews suggest there are no unique hazards or special water resource issues that cannot be mitigated with proper trail BMPs and consideration of water resources during the design, layout and implementation phases of construction {Project File folder 'soils,' Project File document SOILS-005.pdf}; {Project File folder 'trail_313_connector,' Project File documents TR_313-001.pdf and TR_313-002.pdf}.

**Alternative 3** proposes to designate 35 miles of unauthorized routes on the MVUM. About 19 miles of would be proposed to be designated as ATV trails seasonally; approximately 1 mile would be designated to be open yearlong. Some of these would connect existing roads.

About 10 miles of the routes proposed to be designated for ATVs would not be shown on the MVUM until separate site-specific NEPA analysis and decisions, associated with relocating the routes to more sustainable locations to address rutting and erosion concerns are completed and they exist on the ground.

Under **Alternative 3**, 14 miles of unauthorized routes would be proposed to be designated seasonally for use by motorcycles, and 1 mile would be designated for yearlong use {Project File folder 'unauthorized_trails,' Project File document UAT-004.pdf}.

Once unauthorized routes are designated, the Forest Service would be able to expend funds for maintenance and improvements, which are intended to ensure the integrity of travel routes. Consequently, conditions on the routes would improve, as ruts would be bladed, reducing erosion and sediment production.

For a listing of the unauthorized routes proposed to be designated on the MVUM in **Alternative 3**, please refer to Appendix K to the FEIS.

**Alternative 3** would not restrict mechanical transport (bicycles) within the MWSA and 1987 Forest Plan recommended wilderness areas. Observed effects that were tied to mechanical transport use during field review included minor rutting from wet trail use, minor channel disturbance at stream crossings, and some skidding/erosion on steep trail segments. Mechanical transport use appeared to create some sediment source areas that, due to the low intensity of effects and the limited area affected, would not have measureable effects at the 6th-level watershed or stream reach scale. Literature reviewed in Section 3.6.1 A suggests this type of use would likely have only minor watershed-level effects in the future, even with foreseeable moderate increases in the volume of this activity. This information suggests the continuation of mechanical transport use in **Alternative 3** would have minor water resource effects as noted above. Changes in mechanical transport access were not included in the water resource measurement indicator (Section 3.6.1 A).

To summarize the potential water resource effects of **Alternative 3**, analysis results suggest implementation would reduce sediment risk in four $6^{th}$-level watersheds, maintain current sediment risk in 20 6th-level watersheds, and increase sediment risk in one 6th-level watersheds with sediment-impaired 303(d)-list streams on Bitterroot National Forest lands when compared to **Alternative 2** (No-Action). Beneficial use support is not likely to change in the 20 watersheds with no change in the indicator, and may improve slightly in four watersheds with 303(d)-listed streams. The sole $6^{th}$-level watershed with both a sediment-impaired stream and an increase in the indicator is Bass Creek, which has both a small increase and total in the indicator, and is therefore likely to maintain its level of beneficial use support on-Forest. If **Alternative 3** is chosen it would reduce or maintain sediment risk in 41 6th level watersheds and increase sediment risk in eight 6th-level watersheds without 303(d)-listed streams when compared to the existing condition (**Alternative 2**). Analysis results suggest the eight $6^{th}$-level watersheds with predicted increases in sediment risk would not have measureable sediment increases at the watershed outlets, but would likely have observable increases in sediment source areas. The observable effects include increased fine sediment in the channel substrate adjacent to source areas along with disturbed stream beds and banks where trails directly access channels. Overall beneficial use support in these eight watersheds is likely to be maintained in on-Forest stream reaches due to the influence of large areas without motorized access in each of these watersheds. Resource protection efforts noted in 3.6.4 A (Common to all Action Alternatives) would be carried forward with any Alternative to minimize motorized access resource damage.

***Alternative 4***

Table 3.6-3, see also {Project File folder 'water resources,' Project File document WAT-006.pdf, Table 3.6-6} displays the total potential motorized sediment risk associated with **Alternative 4,** along with the change from the existing condition (**Alternative 2**). Analysis results suggest decreases in motorized access-related sediment risk for 22 of 25 6th-level watersheds with sediment-impaired streams, with reductions of one to eleven percentage points from **Alternative 2**. The Upper Sleeping Child Creek 6th-level watershed's total motorized sediment risk is predicted to decrease from twelve to one percent of background levels. Jordan (2006) suggests that for a sediment input of approximately ten percentage points, "...the sediment input would probably be measurable, and depending on its timing and location, it may have a detrimental impact on water quality for a short time, or on the stream channel at some location." Reducing the motorized access sediment risk to just one percent of background levels would likely have the opposite effect, with **Alternative 4** improving channel conditions for stream reaches in Upper Sleeping Child. The change for Upper Sleeping Child is the largest indicator decrease for a 303(d)-listed stream in any alternative. Improved conditions would include a reduction in channel substrate fine sediment and an improvement in stream bank stability at former motorized route stream crossings and instream reaches that parallel formerly motorized routes. Meadow Creek follows with a reduction of eight percentage points, and East Fork Bitterroot-Jennings Camp Creek, West Fork Bitterroot River- Beaver Creek, and Overwhich Creek 6th-level watersheds with reductions of five percentage points. All other 6th-level watersheds with listed streams would see measurement indicator reductions of one to four percentage points, with the exception of Lower Sleeping Child, Bitterroot River-Larry Creek and Bitterroot River – Spooner Creek, which are predicted to have no change in long-term sediment risk from motorized vehicle use. Table 3.6-6 displays the remaining 17 6th-level watersheds on the 2012 MDEQ 303(d) list with sediment risk indicator decreases less than five percent; potential improvements from these decreases would likely be observed at the source areas, but may not be measureable at the watershed outlets. Beneficial use support would improve adjacent to the source areas affected by motorized access restrictions, but these improvements may not, by themselves, change impairment in downstream reaches or at the 6th-level watershed scale. The analysis results for the remaining three 6th-level watersheds with 303(d)-listed streams in Table 3.6-6 suggest no change in the measurement indicator, and it is not likely these streams would be adversely or beneficially affected by **Alternative 4**.

**Alternative 4** analysis results in Table 3.6-6 include reductions of one to thirteen points in the measurement indicator for 35 different 6th-level watersheds that currently support all pertinent beneficial uses (non-impaired or non-303(d)-listed). Lower Blue Joint Creek, Deer Creek, and Moose Creek have the largest reductions in the sediment risk indicator with decreases from eleven to thirteen percentage points. Twenty-eight other 6th-level watersheds have reductions from nine to one percentage points (Table 3.6-6). Eighteen other 6th-level watersheds currently supporting all beneficial uses would have no change in the measurement indicator, suggesting **Alternative 4** would not change water resource effects from the existing condition (**Alternative 2**) in these watersheds. Observable motorized access-related sediment source areas would decrease with improvements in bank stability at crossings and reductions in fine sediment adjacent to crossings, and within dispersed camping motorized access corridors, and routes within 300 feet of streams where motorized use is restricted.

In 6th-level watersheds that are currently supporting all beneficial uses, the indicator decreases for 31of 49 watersheds with **Alternative 4**, suggesting continued good water quality and beneficial use support. Analysis results also suggest the remaining 18 6th-level watersheds that are currently supporting all beneficial uses would experience no changes in motorized access-related sediment and would not be affected by implementing this alternative. {Project File document WAT-007.pdf} displays current motorized routes in 303(d)-listed watersheds proposed for closure or restrictions in this alternative for sediment concerns, and {Project File document WAT-009.pdf} displays the combined fish habitat and sediment-related proposed changes.

**Alternative 4** would close approximately 15 miles of unauthorized routes {Project File document WAT-005.pdf} and associated motorized access for dispersed camping within 300 feet of streams, which exceeds those closed in other alternatives by about 0.4 mile. This change is included in the calculation and discussion of the measurement indicator and the net change for each 6th-level watershed. For potential effects of these closures, please see the unauthorized route discussion for **Alternative 1**, above. No new motorized routes would be built in **Alternative 4**.

**Alternative 4** proposes to designate 3 miles of unauthorized routes on the MVUM. About 2 miles would be proposed to be designated as ATV trails seasonally; approximately 1 mile would be designated to be open yearlong. Several of these routes would connect existing roads. No unauthorized trails for motorcycles would be proposed for designation in **Alternative 4**. All of the routes would be shown on the MVUM as no separate site-specific NEPA analysis would be required {Project File folder 'unauthorized trails,' Project File document UAT-005.pdf}.

Once unauthorized routes are designated, the Forest Service would be able to expend funds for maintenance and improvements, which are intended to ensure the integrity of travel routes. Consequently, conditions on the routes would improve, as ruts would be bladed, reducing erosion and sediment production.

For a listing of the unauthorized routes proposed to be designated on the MVUM in **Alternative 4**, please refer to Appendix K to the FEIS.

**Alternative 4** proposes to eliminate mechanical transport (bicycles) within the MWSA and 1987 Forest Plan recommended wilderness areas, along with the elimination of motorized use. Observed effects that could be attributed to mechanical transport use included minor rutting from wet trail use, minor channel disturbance at stream crossings and some skidding/erosion on steep trail segments. Mechanical transport use appeared to create some sediment source areas that, due to the low intensity of effects and the limited area affected, would not have measureable effects at the 6th-level watershed or stream reach scale. Literature reviewed in Section 3.6.1 A suggests this type of use would likely have only minor watershed-level effects in the future, even with foreseeable moderate increases in the volume of this activity. Using this information suggests the elimination of mechanical transport use in specific areas in **Alternative 4** would provide minor water resource benefits by reducing the disturbances noted above and overall travel volume on trail segments near streams and through wet crossings. Changes in mechanical transport access were not included in the water resource measurement indicator (Section 3.6.1 A).

Summarizing predicted water resource effects of choosing **Alternative 4**, the reduction in motorized access from the existing condition (**Alternative 2**) would reduce sediment risk in 22 of 25 $6^{th}$-level watersheds with sediment-impaired streams, and in 31 out of 49 $6^{th}$-level watersheds that are currently supporting all beneficial uses. The remaining watersheds would see no change from implementing **Alternative 4**, as no changes in motorized access would occur within their boundaries. Resource protection efforts noted in 3.6.4.A (Common to all Action Alternatives) would be carried forward with any Alternative to minimize motorized access resource damage.

## Over-Snow

Over-snow vehicle use seldom disturbs soils, decreases ground cover, or creates erosion, due to the layer of snow separating the machine from the ground. Occasionally, over-snow vehicle travel will disturb soils on ridges blown free of snow, where no other path is feasible. These areas tend to be extremely minor and far from streams. Snow machine transport to trailheads is considered under open road discussions, below. For these reasons, no water resources effects are attributed to over-snow vehicle use, and they will not be discussed in detail as a water resource effect. There would be no difference between alternatives for this activity.

### *Summary*

**Alternative 4** reduces motorized use effects on water resources over the greatest amount of watershed area, followed by **Alternatives 1** and **3**. **Alternatives 1** and **4** both avoid increases in sediment risk for all watersheds with 303(d)-listed streams; **Alternative 3** would increase sediment risk in one watershed with a 303(d)-listed stream. Motorized-access-related sediment risk is decreased in 11 $6^{th}$-level watersheds with listed streams in **Alternative 1**, while **Alternative 4** decreases sediment risk in 22. The remaining watersheds with 303(d)-listed streams would have no increase in the sediment measurement indicator in either **Alternatives 1** or **4**. With one exception, **Alternative 3** would not increase motorized sediment risk in impaired streams, but would not decrease risk either. Table 3.6-3 results suggest **Alternative 4** would reduce motorized sediment risk in more of these sensitive watersheds, followed by **Alternatives 1** and **3**.

Watersheds that do not have sediment-impaired or listed streams, and are currently supporting all beneficial uses with the existing level of motorized access, would be less sensitive to sediment changes. **Alternatives 1, 3 and 4** would each reduce motorized access water resource effects from the current condition (**Alternative 2**) by closing most, if not all, known unauthorized routes near streams, continuing a physical barrier program limiting motorized dispersed camping access where effects exceed acceptable levels, and implementing a 30 foot "no-drive zone" around any flowing stream, pond, lake, marsh, or wetland to motorized wheeled access for dispersed camping.

Analysis results suggest that **Alternatives 1, 3** and **4** all meet the project's Purpose and Need, but to varying degrees. Much successful mitigation for reducing water resource effects of motorized use would be carried forward with any alternative.

## C. Cumulative Effects

### Geographic Boundaries

The defined cumulative effects analysis area for water resources is the total area of all the 6th-level watersheds separately analyzed for direct and indirect effects (above), or about 1,127,243 acres of National Forest System lands. This area was chosen as it is the area where water resources may be affected by the decision resulting from the Travel Management Planning Project, and best represents the flow and sediment contributing area to the Bitterroot River managed by the Bitterroot National Forest. The common point where cumulative effects could conceptually be physically measured would be the mainstem Bitterroot River in the vicinity of the north boundary of Ravalli County, as all 6th-level watersheds contribute to this point. Approximately 26 percent of the area (about 405,000 acres) within the Bitterroot River watershed is private land, which is mainly in the valley bottom and downstream of National Forest System lands.

### Activities within the Cumulative Effects Analysis Area

Certain conditions virtually eliminate private land sediment effects on Bitterroot National Forest water resources. Private land activities rarely affect sediment regimes or water quality on Forest lands, as the vast majority of private lands in the Bitterroot River watershed are downstream of the Forest, and these impacts cannot travel upstream. The Bitterroot National Forest also has very few private inholdings that could affect its water resources, and therefore this potential sediment source is also extremely small. For these reasons, private land effects were considered by grouping streams with the MDEQ 303(d) list (which considers both private and National Forest System lands), rather than including the private road systems and watershed contributing area in the water resources effects measurement indicator. By considering the sediment sensitivity of listed streams on-Forest, the similarly sensitive downstream reaches on private land are also considered. The Bitterroot National Forest attempts to fulfill its water quality management responsibility by supporting beneficial uses on-Forest and supplying the best possible water quality to private lands downstream.

Past actions have contributed to the existing condition for water resources, which is described in Section 3.6.3 (Affected Environment). The construction of National Forest System roads, associated primarily with timber harvest projects, resulted in adverse effects to water resources, which have diminished with time. Current and reasonably foreseeable activities which include road construction are very minimal (Appendix A to the FEIS), and little water resource effect is expected due to the lack of activity. Section 3.6.3 G (Integration of Effects) summarizes the existing condition and beneficial use support for the water resources analysis area.

Appendix A to the FEIS describes past, present, and reasonably foreseeable forest and other activities which, when combined with the activities proposed in the Travel Management Planning Project, could potentially create disturbances and sediment, resulting in cumulative effects to water resources.

## Summer

Some forest activities have negligible effects on water resources, particularly sediment increases, due to the following reasons:

- Ø The activity's location away from water resources isolates it from project area water resources
- Ø The activity's disturbance is too small to produce an effect
- Ø Project design features are applied to reduce the activity's effects to negligible levels
- Ø The time elapsed and natural recovery that has occurred since project completion has diminished effects to negligible levels

Examples of forest activities which, when carried out consistent with existing regulations, produce negligible cumulative effects to water resources include:

- Ø Personal Use Firewood Cutting
- Ø Personal Use Christmas Tree Harvesting
- Ø Invasive Plants Management
- Ø Public Use
- Ø Most Special Uses\permits, except those that authorize timber hauling and other heavy equipment uses
- Ø National Forest Timber Harvest that occurred more than 20-30 years ago, or was implemented with modern (post 1991) BMPs.
- Ø Motorized access on designated routes or access corridors for dispersed camping farther than 300 feet from water resources

There are other forest activities which could result in cumulative effects in conjunction with the motorized access being considered in the Travel Management Planning Project. Typically, water resources cumulative effects are limited to water yield and sediment influences. Water yield is not a concern with the activities proposed in this project; consequently, the discussion will focus on sediment.

Several present and reasonably foreseeable activities have the potential to influence water quality and natural channel processes within the cumulative effects analysis area by changing fine-sediment production. These include the transportation system, road and trail management, wildfire suppression, cattle grazing, timber harvest, mining, public use (recreation), wildfires, and natural disturbance events. Some of these activities are constant or occur on an annual basis, e.g., road management or cattle grazing. The effects from these types of activities are considered *chronic*. Although chronic effects are generally low-to-moderate in magnitude, they occur with moderate-to-high frequency. In contrast to *pulse* effects discussed in the Affected Environment section, chronic effects may not allow for significant recovery of water resources between events, and therefore may degrade the resource over the longer term. All current and planned activities have associated practices or guidelines (e.g., road and timber harvest BMPs) to minimize sediment production and mitigate the effects on water resources, including the activities proposed in this project.

### *Transportation System*

Very few new permanent roads and trails are proposed with any of the present and reasonably foreseeable activities described in Appendix A to the FEIS. The Three Saddle timber harvest project includes temporary road construction, but the roads would be obliterated and rehabilitated following the project's completion. Best management practices would be implemented to limit/reduce erosion and sedimentation to streams in the analysis area. Several new, permanent road and trail segments are proposed with the

Darby Lumber Lands Watershed Improvement and Travel Management Project. These would be minimal in length (3-4 miles total), and would be located and built using BMPs and Soil and Water Conservation Practices associated with road building {Project File document WAT-003.pdf} to minimize sediment risk. These road or trail-building activities are proposed to be paired with extensive road prism storage and decommissioning, which would decrease sediment risk, thereby reducing the overall effect of the motorized route system within the project area.

Several present and reasonably foreseeable projects listed in Appendix A to the FEIS will decommission, store, or close system roads and "undetermined" status roads. In the case of some "undetermined" status roads, they may be placed on the Forest's Transportation System if the project-specific travel analysis determines they are necessary for future management. The Darby Lumber Lands Watershed Improvement and Travel Management Project proposed to place approximately 55 miles of closed roads into long-term storage, and decommission an additional 66 miles of roads. The Three Saddle Vegetation Management project will decommission approximately 9.5 miles of road, and place about 1.1 miles of road in long-term storage. The Como Forest Health Protection Project will place approximately 3.1 miles of undetermined roads in long-term storage, and will decommission about 3.5 miles of undetermined roads. The Meadow Vapor project will be proposing to decommission and place roads in long-term storage.

Decommissioning roads or placing them in long-term storage lowers the risk of erosion and sediment reaching streams. Decommissioning of roads on the Forest's Transportation System, by removing them from the landscape, would return these areas back to the productive land base, and allow for soil recovery through either active rehabilitation treatments or natural recovery.

Road use effects associated with the transportation system and their cumulative effects are considered below (Cumulative Effects from the Implementation of the Alternatives). This effects discussion considers all road use, including recreational, administrative, and project (e.g., timber sale hauling) activities.

***Road and Trail Management***

Routine road maintenance includes blading, gate repair/replacement, periodic upgrades of drainage structures, gravelling of surfaces, and other sediment-reduction work, cleaning ditches and culverts, brushing, and debris removal. Routine trail maintenance includes clearing, brushing, and opening of trails, and the cleaning of drainage structures such as water bars and rolling dips. These activities are intended to improve safety, reduce the time that water is on roads and trails surfaces, and to help stabilize them. This reduces overall sediment risk to streams. Although some sediment is generated immediately after maintenance-related disturbances, maintenance and BMP upgrades are considered beneficial over the longer term.

***Wildfire Suppression***

Mitigation efforts would include the use of local Resource Advisors to assist with best fire line location and design, selection of low-impact methods or equipment, switching to hand line construction near streams, and post-fire treatments to control erosion and unauthorized ATV traffic. Fire staffs are routinely trained to consider environmental effects of suppression efforts, including ground disturbances. Sediment contribution to streams is minimized by these tactics, and overall water resource effects of fire suppression are minor and of short duration for most incidents. Due to the availability of fire suppression funds for rehabilitating related disturbances, few sites contribute sediment to water resources over the long term.

***Cattle Grazing***

Allotment management plan revision is on-going, and all new plans allow for protection of water resources by using various "triggers" to respond to forage utilization patterns and to remove cattle prior to serious water resource damage. At this time, about 50 percent of grazing allotments on the Bitterroot National Forest have been revised with increased consideration for natural resources, or closed to grazing altogether. Projects have recently been implemented on the Forest to fence cattle away from areas where there have been re-occurring impacts to streams that contain native fish. Fisheries and Watershed staff routinely monitor riparian condition, which is summarized in annual Forest Plan Monitoring and Evaluation Reports {Project File documents FPMON-031, 033, 034, 036.pdf} (Monitoring Report Item 22 - Riparian Area Condition), and promote adaptive management to address sediment-producing sites.

***Timber Harvest, Prescribed Burning, and Associated Activities***

In ongoing timber sales, all commercial treatment areas have been limited to upland sites that would have little effect on local streams, and this trend is likely to continue with reasonably foreseeable timber harvest projects. Harvest within INFISH RHCA buffer zones (300 feet for fish-bearing streams, 150 feet for perennial non-fish bearing) must pass the test of being at least benign, if not beneficial, for fish habitat. This prerequisite drastically decreases the potential for sediment production due to harvest or fuels treatments, and mitigates harvest effects on water resources.

Excluding road use (considered below), neither the ongoing nor proposed future levels of harvest nor prescribed burn activities is substantial enough to be detrimental to water resources. In combination, these activities have helped to reduce fuel loads and the potential for future catastrophic wildfires.

Prescribed burning used to manage vegetation generally creates little sediment risk, as it is applied within restricted conditions designed to minimize severe burning of soils and water quality impacts. However, severe burning could consume duff layers and cause physical damage to surface mineral layers or create a water repellant layer that impedes infiltration and creates surface conditions conducive to sediment production. However, this has been rare on the Bitterroot National Forest. Generally, herbaceous vegetation grows back after prescribed burns within a year, acting as an effective erosion control.

***Mining***

Few mining claims are currently being worked on the Bitterroot National Forest, and the present level of effects is minimal. Potential effects include fine sediment production, bank alteration, riparian vegetation removal, and metals contamination. Remediation efforts at the Stansbury Mine and Hughes Creek have largely eliminated sediment production at these larger sites, although some minor landscape and channel adjustments still occur. Major new mining efforts have been uncommon, and must have an operating plan that includes protection for stream channels. This requirement has kept mining-related sediment at minor levels over the last ten years; this trend is likely to continue for the short term. Currently there is one mechanized mining proposal on Hughes and Taylor Creeks (West Fork Ranger District) in the operating plan development stage. Several claims in the same area are commonly worked by hand on an intermittent basis, with minor sediment production that is unlikely to affect the total cumulative effects levels for those streams.

***Activities on State and Private Lands***

State and private lands were considered for their potential to add to cumulative effects. The types of activities on these jurisdictions include all those possible on National Forest System lands, with the addition of housing development and agriculture. The scale and intensity of activities may differ, as uses and regulations on these lands are different than those of the Bitterroot National Forest. Watershed locations differ greatly, however, and therefore the two jurisdictions were considered differently.

Reasonably foreseeable timber harvest projects activities on State land include partial-cut thinning and fuels treatments. Grazing permits are often issued for State School Trust Lands, but only a few grazing allotments are located within the boundaries of the Bitterroot National Forest due to the lack of suitable forage. Motorized access, timber, and grazing activities on State lands are highly regulated to reduce environmental effects, with BMPs, restricted motorized access, and administrative oversight of activities (e.g., timber sale contracts) used to control disturbance levels. With only approximately two sections within each township in State jurisdiction and the operational controls noted above, the potential for substantial additions to cumulative effects is low.

The location of private lands downstream of National Forest System water resources prevents the private land activities from affecting water quality or sediment loads in the upstream analysis area. When considering the entire Bitterroot River watershed, private land activities can add to cumulative sediment issues. It is more difficult to estimate cumulative effects (especially associated with reasonably foreseeable activities) on downstream private lands. Most private landowners have good track records of protecting resources, but the range of effects varies more than on public lands for several reasons. Regulations exist to minimize impacts (e.g., Streamside Management Zone laws), but oversight is much less than that on Federal and State activities. Sediment control is often a lower priority on private lands, where budgets are limited and goals are different. Best management practices are voluntary, and implementation and effectiveness rates vary on private lands. Ownership may change quickly, along with land use, conservation practices, and intensity of use. For these reasons, the potential for cumulative effects related to sediment should be considered moderate-to-high on private lands. The Travel Management Planning project decision would not affect motorized access or its effects on private lands, and the potential for cumulative effects originating from private lands is assumed to be the same for all alternatives.

***Wildfires***

Wildfires generally tend to affect sediment from hillslopes for 3-5 years, but can have effects up to 10 years later. Size, location, severity, and time since the last fire can all affect recovery and sediment contribution rates. Sediment production from these sites has also varied, from gully-cutting to bedrock and debris flows, to virtually no erosion on grass or underbrush fires on shallow slopes.

Existing roads may compound the effects of stand-replacing fires. Roads can increase surface and subsurface drainage efficiency, routing upslope waters to natural channels at higher rates. Greater effects are expected with high intensity fire over a large area and where road densities are higher.

The incidence and severity of wildfires is predicted to increase, which would generally result in higher sedimentation rates than currently observed. While these events are considered natural, they can interact with human activities which could in turn aggravate or extend wildfire effects.

***Natural Disturbance Events***

Natural disturbance events, such as fires, blowdowns, and floods, will continue to influence hydrologic and erosion processes within the watersheds of the Analysis Area. Given the current vegetative conditions, drought and associated fuel accumulations, there is potential for wildfires to occur that may be outside the range of conditions (intensity, size and duration) that have occurred over the last few hundred years. Depending on the intensity and area burned, accelerated soil erosion is possible, particularly where hydrophobic soils may be formed. Channel adjustments could be expected, especially during years of average or higher precipitation/runoff conditions. Stream systems will stabilize as vegetative recovery progresses, and sediment loads diminish towards long-term averages.

## Over-Snow

Over-snow vehicle use seldom disturbs soils or causes loss of ground cover or erosion, due to the layer of snow separating the machine from the ground. This would apply to roads, trails, and areas. There would be negligible cumulative effects to water resources associated with personal use firewood cutting and Christmas tree harvesting, motorized over snow use, public use, special uses\permits, and activities on state and private lands. See Section 3.6.4 A (Effects Common to All Action Alternatives, Over-Snow) for more discussion on motorized over-snow effects.

As many roads and trails would be snow-covered during the winter months, this would limit their use by motorized vehicles, both by the public and Forest Service personnel. Subsequently, forest activities including road and trail management and invasive plants management would not occur. Cattle typically graze on allotments on National Forest System lands between May 15 and October 31; they would not be grazing during winter months.

Timber harvest projects to be implemented during the winter months would contain sale contract language regarding operating on frozen or snow-covered ground to prevent adverse effects to soils, erosion, and sedimentation. Therefore, there would be negligible cumulative effects to water resources.

## Cumulative Effects from the Implementation of the Alternatives

To help estimate the cumulative effects associated with motorized vehicle use for each alternative, the sediment risk indicator was summarized for the entire analysis area, and displayed in Table 3.6-7, Total Motorized Access Sediment – Percent of Background, by Alternative, in {Project File document WAT-006.pdf}. Table 3.6-7 summarizes the water resource motorized access cumulative effects by considering only the portion of the access changes that have the greatest potential to affect streams. Total motorized access mileage changes are displayed for each alternative in Chapter 2, Table 2-20 (Proposed Changes by Alternatives).

It is appropriate to summarize the 6$^{th}$-level watersheds into a whole, as all contribute flow and sediment to the Bitterroot River. This cumulative effects measure can be used to compare between alternatives, but should not be used as an exact measure of sediment produced. Measurement indicator values represent "worst-case" scenarios, including the influence of growth in motorized use over the next ten years (Section 3.6.1). The measurement indicator for 6$^{th}$-level watersheds with 303(d)-listed streams is also grouped and summarized for display.

Table 3.6-7{Project File document WAT-006.pdf} shows the results from the sediment model and watershed indicator summed by watershed group (6$^{th}$-level watershed with and without sediment-impaired 303(d)-listed streams) and for the analysis area as a whole, for each alternative.

The summed measurement indicator values in Table 3.6-7 suggest that there would be minor changes in motorized access sediment risk across the analysis area with **Alternatives 1** and **3**, and a larger change with **Alternative 4**. The other potential sediment sources noted in the cumulative effects discussion above would not be affected by the Travel Management Planning Project, and would be consistent across all alternatives. As with direct and indirect effects, there are other aspects of cumulative effects common to all alternatives (Section 3.6.4 A).

### *Alternative 1*

The Total Motorized Access Sediment – Percent of Background indicator decreases one percentage point from the Existing Condition (**Alternative 2**) in each watershed grouping: 6$^{th}$-level watersheds with 303(d)-listed streams, watersheds without listed streams, and the combined 6$^{th}$-level watersheds making up the analysis area. This reflects an improvement in cumulative effects or sediment risk from about 5 percent of background to about 4 percent of background (approximately a 20 percent reduction). As the indicator value for either **Alternative 1** or **2** is quite small (less than 5 percent of background sediment), the potential decrease in sediment predicted for **Alternative 1** would be difficult to measure at the cumulative effects analysis scale due to errors inherent in sediment measurement, but may be detectable at smaller scales. Table 3.6-3 values suggest improvements in sediment risk in 10 of 22 watersheds listed with sediment impairments, and in 16 of 52 6$^{th}$-level watersheds without listed streams. The remaining 48 6$^{th}$-level watersheds (12 with listed streams and 36 without listed streams) are predicted to see no change in cumulative effects. Analysis results for individual 6$^{th}$-level watersheds are displayed in {Project File document WAT-006.pdf}, and Table 3.6-3, and discussed in Section 3.6.4 B.

### *Alternative 2, No Action*

The risk of sediment-related cumulative effects would be unchanged with **Alternative 2.** Motorized access within the analysis area would not change if **Alternative 2** is implemented, and risk for sediment-related adverse effects would also not change for individual 6$^{th}$-level watersheds, watershed groups, or the entire analysis area. The level of direct, indirect, and cumulative motorized access effects would most likely increase proportionally with growth in motorized recreation, but would be limited to the existing route system. Over the short-term (10 years), sediment-impaired listed streams would experience sediment effects from motorized access at the same or slightly increased levels due to growth in motorized recreation on the existing route system. Growth, and changes in cumulative effects, is harder to predict for the long term (greater than 10 years), but there are no indications that motorized recreation would decrease in that time frame.

The value of the averaged measurement indicator for grouped watersheds in **Alternative 2** suggests a minor level of sediment risk at the cumulative effects analysis-area scale, although Total Motorized Access Sediment – Percent of Background indicator values for specific 6$^{th}$-level watersheds range from zero to 16 percent of background levels {Project File document WAT-006.pdf, Table 3.6-3}, and Section 3.6.4 B, which suggests a wide range of sediment risk for 6$^{th}$-level watersheds across the analysis area. Section 3.6.3 includes more information on Affected Environment and existing cumulative effects levels.

***Alternative 3***

**Alternative 3** proposes increasing motorized access slightly over that currently available in **Alternative 2**, mainly on existing trails, and measurement indicator values for grouped watersheds suggest that the increase in sediment risk, and therefore also for cumulative effects, is minor at the cumulative effects analysis area scale. Values displayed in Table 3.6-3 suggest **Alternative 3** would not change sediment risk in any sediment-impaired 303(d)-listed watersheds, would reduce sediment risk in six of 52 6$^{th}$-level watersheds without listed streams, and would slightly increase sediment risk in nine watersheds without listed streams. Motorized access-related effects on impaired streams is predicted to be unchanged in this alternative, although there is a minor increase in sediment risk for the nine 6$^{th}$-level watersheds without listed streams. Listed streams not supporting beneficial uses due to motorized access-related fine sediment would most likely continue in this status unless other sediment-reduction projects are proposed. Watersheds without listed streams are currently supporting beneficial uses, and would be generally less sensitive to small increases in sediment possible with **Alternative 3,** although some source area effects would be observed at crossings and channel segments with parallel motorized routes (Section 3.6.4 B). The small net change from the existing condition (**Alternative 2**) is due to very little new trail construction within sediment-contributing distance of streams, and only minor increases in motorized access on existing trails.

***Alternative 4***

Table 3.6-3 values suggest implementing **Alternative 4** would decrease motorized access-related sediment risk in 18 of 22 6$^{th}$-level watersheds with listed streams, with the remaining four in this group being unchanged. As a whole, the watershed group with listed streams indicator would drop from 5 percent in **Alternative 2** to 1 percent in **Alternative 4**, a decrease of four percentage points of background (Table 3.6-7 in {Project File document WAT-006.pdf}), and a relative reduction of 80 percent. This value suggests **Alternative 4** would reduce motorized access-related sediment risk in the analysis area by reducing direct, indirect, and cumulative effects in 18 6$^{th}$-level watersheds with sediment-impaired streams. For 6$^{th}$-level watersheds without listed streams, **Alternative 4** would reduce sediment risk in 35 of 52 watersheds, and keep current levels in the remaining 17 when compared to **Alternative 2**. The risk for motorized access-related sediment to contribute to cumulative effects is reduced in **Alternative 4** by a combination of reducing the motorized route mileage within 300 feet of streams, and reducing the motorized wheeled access corridor for dispersed camping to 300 feet total width (150 feet each side) of a designated motorized route. Direct and indirect effects in individual 6$^{th}$-level watersheds are discussed in Section 3.6.4 B.

## Cumulative Effects Finding

Analysis results displayed in Table 3.6-7 suggest that **Alternative 4** would reduce the risk for motorized access-related cumulative effects by the greatest amount, with **Alternative 1** also reducing risk, but to a lesser extent. **Alternative 2** would maintain the current level of motorized access, and therefore also the current level of motorized access-related sediment risk. Measurement indicator values suggest **Alternative**

**3** would have a higher sediment risk than any other alternative, but the net increase over the existing condition (**Alternative 2**) is near zero, suggesting no observable or measureable change in motorized access-related effects at the cumulative effects analysis area scale. **Alternative 4** has the highest probability of reducing motorized access-related sediment cumulative effects in streams currently impaired by sediment.

Private land contributions of flow and sediment within the cumulative effects analysis area would be the same for all alternatives, as the decision for this project would not affect private land motorized access.

Also, any roads and trails closed to motorized travel would still be open to foot, horse, and possibly mechanical transport traffic (with exceptions for mechanical transport use in recommended wilderness areas in **Alternatives 1 and 4**), and, therefore would still experience disturbance, albeit at a reduced level. This situation creates a lowered potential for sediment reduction and a decreased benefit to water resources than if the route was closed altogether. Some unauthorized routes closed to motorized access would be rehabilitated, and others would be left to recover naturally. Please refer to the effects indicator discussion on trail erosion related to various travel modes (Section 3.6.1 A, Effects Estimation and Comparison) of this document.

Furthermore, the inclusion of the project design features listed in Chapter 2, Table 2-19, of this FEIS, including Soil and Water Conservation Practices, and adhering to Region 1 Soil Quality Standards, in the proposed activities, as well as in Present and Reasonably Foreseeable Activities, will result in a reduction in adverse impacts to the soil resource, with beneficial effects on water resources.

It should be noted that implementing **Alternatives 1, 3, and 4** would reduce the cumulative effects of past activities because many unauthorized routes would no longer be available for motorized travel, and the potential for causing erosion and sediment production would be reduced.

## 3.6.5 Consistency with the Forest Plan, Laws, and Regulations

The Travel Management Planning Project is essentially a planning effort, and does not create new ground disturbance. As such, consistency with existing regulation is a matter of incorporating various concerns into the planning effort. This has been done in all phases of the project.

### A. Bitterroot National Forest Plan

Consistency with the Bitterroot National Forest Plan forest-wide resource and management area standards applicable to water resources would be accomplished the following ways:

#### Forest-wide Management Standards:

Soil and Water Conservation Practices will be a part of project design and implementation to ensure soil and water resource protection (USDA Forest Service 1987a, II-25)

Actively reduce sediment from existing roads (USDA Forest Service 1987a, II-25)

As part of project planning, site-specific water quality effects will be evaluated and control measures designed to ensure that the project would meet Forest water quality goals; projects that will not meet State water quality standards will be redesigned, rescheduled, or dropped (USDA Forest Service 1987a, II-24)

*How addressed:*

Region 1 Soil and Water Conservation Practices applicable to travel management planning were included in the table of Project Design Features (Table 2-19) in Chapter 2 of the FEIS.

Hydrology, Soils, and Fisheries specialists worked with the Interdisciplinary Team (FEIS Appendix D- List of Preparers) to minimize impacts to watershed values. A hydrologist field reviewed existing site conditions on system routes and unauthorized routes with water resources concerns in all alternatives {Project File folder 'field_review_notes_hydrology,' Project File document FR-NOTES-HYD-001, 002, 003, and 004.pdf}. Utilizing this data, the hydrologist was able to determine necessary closures or modifications of routes to protect water resources. Standard environmental protections were instituted in the planning process. These included consideration of sedimentation and erosion, and effects on water quality, in-stream habitat, and beneficial uses by:

- Limiting new construction that could negatively affect water resources, especially crossings and riparian route segments, during planning
- Changing season of use to minimize rutting and erosion
- Limiting type of vehicle to that appropriate for the trail prism width
- New access was proposed only where the location would not threaten natural resources
- Site-specific water quality effects would be analyzed during planning and project design for specific trail construction or improvements
- The Travel Management Planning Project DEIS was provided to the Montana Department of Environmental Quality, as will this FEIS

### Management Area Standards:

***Management Area 5***

Management activities will be designed to protect the municipal watershed (USDA Forest Service 1987a, III-40)

*How addressed:*

Existing trails in municipal watersheds are maintained as needed to reduce water quality effects (Sections 3.1.3 B and 3.6.3 F detail sediment-reduction activities on Bitterroot National Forest roads and trails).

**All alternatives** keep sediment risk in municipal watersheds at or below the existing level, which has been supporting beneficial uses (including drinking water uses) without problems for the recent past {Project File Document WAT-006.pdf}, Table 3.6-2.

***Management Area 10:***

The bog near the Lost Trail Ski Area parking lot should be protected to reduce short and long-term degradation (USDA Forest Service 1987a, III-70)

*How addressed:*

No new motorized use is proposed near the bog in **any alternative**.

**All alternatives** would be in compliance with applicable forest-wide and management area Forest Plan standards.

## B. Montana State Regulation

Objective:
***Administrative Rules of Montana (ARM) 16.20.603***

Best Management Practices are the foundation of water quality standards for the State of Montana. Specific BMPs have been developed to reduce non-point source sediment related to road and silvicultural activities. The Forest Service has agreed to follow BMPs in a Memorandum of Understanding with the State of Montana.

*How addressed:*

The BMPs related to planning ground-disturbing activities, including travel management, were considered when locating potential new connector routes and authorizing motorized use on unauthorized routes described in the 2001 Tri-State Decision. Please see how the Bitterroot National Forest addressed Forest Plan Standards and Guidelines, above, for pertinent discussion to address BMP requirements. Any ground-disturbing activities that are generated by this planning project would be assessed for water resource effects through another round of NEPA documentation.

Objective:
***ARM 17.30 Sub-chapter 6***

This regulation details water quality standards for the State of Montana. The USDA Forest Service has primary responsibility to maintain water quality standards on lands under their jurisdiction in the State of Montana.

*How addressed:*

All activities were assessed for their potential effects on water quality, with results being considered in light of existing conditions, stream type, and designated beneficial uses. Compliance with existing protective regulations (e.g., MT Streamside Zone Management law, INFISH Forest Plan Amendment, Road BMPs, Forest Plan Standards and Guidelines, and the Clean Water Act) was also reviewed during the planning process. To the best of their ability, the Forest Service has estimated water quality effects and instituted protective measures meant to keep effects to the practical minimum.

Objective:

Make progress towards meeting sediment TMDLs

*How addressed:*

Bitterroot River Sediment TMDL (MDEQ 2011) goals include reducing sediment contributing area at stream/road crossings to 200 feet, and lengths of road segments paralleling streams to 500 feet in sediment-impaired watersheds (Table 3.6-2). BMP upgrade projects, maintenance, road closures, storage, and decommissioning activities from other projects are all being actively implemented on the Bitterroot National Forest at this time. Motorized access changes proposed in **Alternatives 1** and **4** of this Travel Management Planning Project also promote this goal to a degree by limiting travel on selected routes. Once an alternative is chosen, analysis to determine the most appropriate and effective sediment-reduction activities (e.g., crossing improvements, road storage or decommissioning), can begin.

## C. Clean Water Act

Objective:

Meet Clean Water Act direction, as modified by Montana law. The Clean Water Act (CWA) and its various amendments are the foundation of water resource protection in the United States, and provide guidance at all levels of management. Pertinent components of the CWA include Section 208 of the 1972 amendments to the Federal Water Pollution Control Act (Public Law 92-500), which specifically mandates identification and control of nonpoint-source pollution resulting from various activities.

Clean Water Act, Sections 303, 319, and 404. Section 303(d) directs states to list water quality impaired streams, and to develop total maximum daily loads to control the non-point source pollutant causing loss of beneficial uses. The 2012 Montana 303(d) list of Water Quality Impaired Streams (MDEQ 2012) is used in this report. At this time, TMDLs have been developed for the East and West Forks of the Bitterroot River (MDEQ 2006), and the mainstem Bitterroot River (from the confluence of East and West Forks to the Clark Fork) (MDEQ 2011). TMDLs include watershed restoration plans or guidance specific to their planning areas. Section 319 directs states to develop programs to control non-point source pollution, and includes federal funding of assessment, planning, and implementation phases. At this time, no known Section 319 projects would be detrimentally affected by proposed project activities. Section 404 controls the dredge and fill of material in waterbodies of the United States; the current proposal for the analysis area does not contain any activities that need special permits under this regulation. Implementation of various road and trail treatments or new trail segments may need various permits in the future.

*How addressed:*

Section 208 is addressed through the practice of including BMPs into the planning, design, and implementation phases of this and other projects. Watershed, soil, and fisheries specialists worked with the Travel Management Planning Project ID Team to control sediment production by minimizing new trail segments on overly steep ground and riparian areas, and minimizing new stream crossings. Unauthorized routes were analyzed for water resource impacts through GIS and ground surveys. Those that increased sediment risks were proposed for closure in **Alternatives 1, 3** and **4**.

The analysis area was reviewed for effects to 303(d) listed streams for the benefit of the Responsible Official. A risk measurement indicator (Total Motorized Access Sediment and Percent of Background) is displayed and discussed for specific and grouped 6$^{th}$-level watersheds with 305(b) and 303(d)-listed (sediment/siltation) stream segments. A range of alternatives gives the Responsible Official a variety of options to reduce water resource effects.

The mainstem Bitterroot River and associated tributaries TMDL process finished in 2011, completing sediment and thermal TMDLs for the entire river basin. A finished TMDL, 305(b), or 303(d) listing for sediment does not preclude all activities in the contributing area for a given waterbody, but does emphasize a voluntary program of non-point-source mitigations or BMPs. Any proposed activities in 303(d)-listed watersheds must be consistent with **Montana State Code (75-5-703, Annotated 2001) provision 10 c) which states that " new or expanded nonpoint source activities affecting a listed water body may commence and continue provided those activities are conducted in accordance with reasonable land, soil, and water conservation practices."** The Administrative Rules of Montana (ARM 17.30.602) define these as "methods, measures, or practices that protect present and reasonably anticipated beneficial uses." Appropriate practices may be applied before, during, or after pollution-producing activities. It is important to note that "reasonable soil, land, and water conservation practices" are different from BMPs, which are generally established practices for controlling non-point source pollution. BMPs are practices that provide a degree of protection for water quality, but may or may not be sufficient to achieve Water Quality Standards and protect beneficial uses. "Reasonable soil, land, and water conservation practices" include BMPs, but may require additional conservation practices, beyond BMPs, to achieve Water Quality Standards and restore beneficial uses. Forest Service proposals are required to utilize all practical BMPs pertinent to the activities. Extra protective measures and mitigating projects (e.g., sediment reduction projects elsewhere in the same watershed) are generally included in most ground-disturbing proposals within or contributing to watersheds with 303(d) listed waterbodies. FSH 2509.22, the Soil and Water Conservation Practices Handbook (USDA Forest Service 1988), provides guidance above and beyond BMPs for reducing impacts of various Forest management activities, including transportation and road systems. Many of these practices are applied to motorized trails systems (e.g., Practice 12.10 – Management of Off-Road Vehicle Use) and roads.

TMDLs include guidance on reducing pollutants that cause loss of beneficial uses, such as sediment, the main water resource concern of motorized access. The Headwaters and Mainstem sediment TMDLs offer different types of guidance, with the Headwaters TMDL being more specific in its sediment-reduction recommendations. Both suggest the use of road BMPs to reduce sediment source areas at stream crossings and road segments parallel to streams to meet TMDL goals. Neither suggests road closures, and neither TMDL included motorized trails or motorized access for dispersed camping in their analysis or recommendations. Most of the sediment-reduction guidance is considered maintenance activity by the Forest Service (e.g., road drainage improvements, gravel surfacing), but some are larger undertakings needing NEPA documentation (e.g., fish passage upgrades at stream crossings). Section 3.6.4 C lists recent activities that meet the intent of the sediment TMDLs, although not all of them are suggested in the finished TMDL Water Quality Restoration Plans (e.g., road storage or decommissioning).

Lastly, emergency closures or long-term closures may be enacted, through appropriate processes, to provide more resource protection if BMPs and other conservation practices are not sufficient. Together, these resource-protection activities, when appropriately applied, would make the alternatives in this project consistent with CWA and MDEQ regulation.

Montana law (MCA75-3-303) establishes non-degradation policy for water bodies and their beneficial uses. Another code recognizes certain activities as “insignificant” in terms of non-point sources. Under MCA 75-5-17(2): “The following categories or classes of activities are not subject to the provisions of 75-5-303:

a. existing activities that are nonpoint sources of pollution as of April 29, 1993;
b. activities that are nonpoint sources of pollution initiated after April 29, 1993, when reasonable land, soil, and water conservation practices are applied and existing and anticipated beneficial uses will be fully protected “

As long as the noted conditions are met, the designation of motorized routes may be considered consistent with Montana and Federal law pertaining to activities that generate non-point source pollution (e.g., sediment). The Travel Management Planning Project proposes no motorized access changes in Designated Wilderness where Class A-1 Outstanding Resource Waters are located.

Section 319 consistency requires the entity proposing an activity with potential watershed effects to research whether any federally or state-funded watershed improvement projects would be affected. There are currently no Section 319 cost-sharing agreements authorized within the analysis area watersheds. Should a Section 319 project be proposed to control sediment in a specific watershed, the Bitterroot National Forest would participate in planning and treatments to reduce sediment as feasible, on public lands.

Section 404 involves regulations controlling the dredge and fill of wetlands; typically this applies to roads where they cross streams, ponds, or wetlands. Any activities developed in the course of this or subsequent analysis will be properly permitted under the CWA and MDEQ regulations before implementation.

All legal direction pertinent to this project and protection of water resources has been reviewed for consistency.

**All alternatives** would be in compliance with applicable Montana State Regulations and the Clean Water Act.

## D. Executive Orders 11988 Floodplain Management and 11990 Protection of Wetlands

Objective:

***Comply with Executive Orders***

<u>How addressed:</u>

The Travel Management Planning Project covers only whether motorized access is allowed on existing routes; it does not analyze the building of new structures within the project area, including its floodplains. Whether motorized access is allowed on a given road or trail does not affect its potential effects on floodplains. Therefore, the project is consistent with Executive Order 11988, Floodplain Management, which protects floodplains and downstream residents from the adverse effects of structures built in jurisdictional floodplains.

There are jurisdictional wetlands within the project area. The effects upon these wetlands are considered for each alternative in Chapter 3 of this document (Water Resources, Section 3.6). This project does not provide for construction of new roads or trails in wetlands; additionally, any new road or trail construction effects would be analyzed in a subsequent document. All alternatives occur under an ongoing, active program of implementing BMPs to protect water resources, including wetlands. These factors insure that the project is consistent with Executive Order 11990, Protection of Wetlands.

## 3.6.6 Changes between Draft EIS And Final EIS

- Minor grammatical edits were made to correct typographical errors and improve readability
- Section 3.6.1 (Scope of Analysis and Analysis Methods) was rewritten to improve clarity and organization. This was done in response to comments on the DEIS. The two water resource effects measurement indicators used in the DEIS were changed to a single indicator (Total Potential Motorized Sediment- Percent of Background) in the FEIS which integrates the effects from all forms of motorized access, including motorized access for dispersed camping, open roads, and trails. Additional discussion of separate 6th-level watersheds is provided to improve the resolution of the analysis, and to address motorized access effects at the 6th-level watershed scale. New text was added including effects of motorized access for dispersed camping, differences in motorized use impacts due to trail, rider, and machine characteristics, trail maintenance, and wetlands.
- Section 3.6.1 A (Effects Estimation and Comparison). Text was added to explain the background and use of the water resource measurement indicator.
- Section 3.6.3 (Affected Environment). Much of this section was moved to Section 3.6.4 C (Cumulative Effects) to clarify the cumulative effects discussion for the existing condition. This was done in response to public comments on the DEIS. New information received on the current condition of water resources within the analysis area was incorporated into the discussion.
- Section 3.6.3 (Affected Environment), Table 3.6-2. The column titled Water Quality Classification was added to the table, which was also updated to reflect the most current MDEQ water quality information (2012 305(b)/303(d) list). This was done in response to public comment on the DEIS,
- Section 3.6.4 (Environmental Consequences) was rewritten to include the effects of motorized access for dispersed camping, differences in motorized use impacts due to trail, rider and machine characteristics, trail maintenance and wetlands. This was done in response to comments on the DEIS. Table 3.6-3 replaces Tables 3.6-3 to 3.6-5 in the DEIS. Measurement indicator tables were built for each alternative to display the results for individual 6th-level watersheds. These tables were incorporated into the FEIS as {Project File document WAT-006.pdf}. The tables are too large (approximately 31 pages) to include in the FEIS. Discussion on the analysis results represented by these tables was added to Section 3.6.4.
- Section 3.6.4 A (Effects Common to All Action Alternatives). Effects associated with over-snow vehicle use were added.
- Section 3.6.4 C (Cumulative Effects). The effects discussion for the entire Forest and Bitterroot River watershed were expanded and also moved to the section. Effects associated with over-snow vehicle use were added.
- In response to public comments on the DEIS, new literature was reviewed, cited if applicable, and added to Appendix B (Literature Cited). The new literature for Water Resources is also listed and commented on in {Project File folder 'water_resources,' Project File document WAT-002.pdf}.
- Section 3.6.5 (Consistency with Forest Plan, Laws, and Regulations. Rewritten to provide clarity and organization.